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A FURTHER AID IN THE DIAGNOSIS OF ŒSOPHAGEAL STENOSIS

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THE following report is interesting as an illustration of the difficulty sometimes met in attempting to make a differential diagnosis in cases of œsophageal stenosis.

E. S., an emaciated child, nine years old, was brought to the dispensary of the Jewish Hospital in July, 1907. Her family history was negative, and she had never been ill up to her present attack. There was a very indefinite history of having swallowed a small pewter spoon, such as are sold with little platters of candy. This is supposed to have happened when the patient was four years old, but the patient says that she is not sure whether she really swallowed the spoon, and the parents know nothing of the incident.

The present history dates back a year. The parents noted that the child would "spit up" most of the solid food that she ate. Sometimes she would struggle with a bolus of food, and then, after a time exclaim, "Oh, it just went down." At this time there was no difficulty in swallowing milk, eggs, or pultaceous food, but the child states that even at this stage of her ailment she noticed that the act of swallowing was accompanied by a peculiar noise located in the throat. Gradually, the act of deglutition became more and more difficult of performance, until finally even water had to be taken in sips. The food is not always rejected as soon as it is swallowed, there being often an interval of half an hour between the time of swallowing and the time of regurgitation.

Physical Examination. The patient weighs only 38 pounds, and shows all the other signs of emaciation. Temperature, pulse, respiration, chest, abdomen, and extremities are normal. Swallowing is accompanied by a gurgling sound at the left side of the neck, opposite the cricoid cartilage. At this site the neck seems to bulge when water is swallowed, and palpation over this same site discloses a crepitation, as of gas, under the palpating finger. It is impossible to elicit typical swallowing sounds.

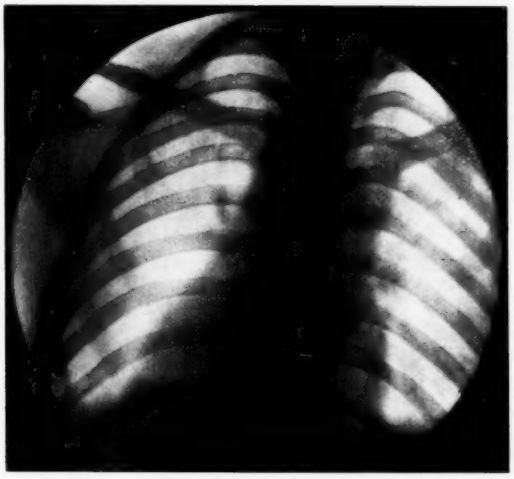

Fig. 1. Bismuth emulsion above site of stricture.

At the first visit the child swallowed a number 7 (French) soft bougie, and it seemed to go as far as the stomach. A week later, a No. 12 was introduced, and still a week later a number 17. It was noticeable, however, that this number 17 bougie was swallowed at times with ease, whereas at other times it was impossible to introduce it farther than ten inches. Six months previous to coming to our dispensary, the patient had been seen by Drs. Clemens and Clopton, both of whom had succeeded in passing into the stomach fairly large sized bougies.

Here, then, was a child whose chief complaint was an almost complete dysphagia, and consequent emaciation. Owing to the uncertainty concerning trauma to the œsophagus, it was

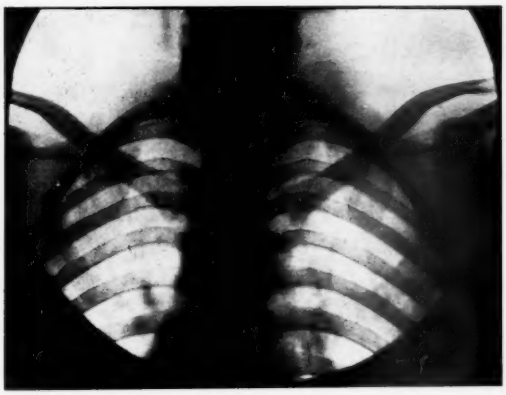

Fig. 2. Showing silk woven bougie coiled on itself above site of stricture.

suggested by Dr. Clemens that we might be dealing with a case of hysteria of the monosymptomatic type that is so commonly encountered in children. The physical signs in the neck, however, and the constant pronounced hunger seemed to speak against this. If hysteria could be ruled out, there remained to be considered only stricture and diverticulum of the œsophagus. Against stricture was the fact that there was no definite history of trauma, and speaking in favor of diverticulum were the facts of the retention of food for quite a while before it was rejected, the bulging opposite the cricoid cartilage, and the capricious manner in which the bougie seemed to engage in the œsophagus at different times.

Before doing an external œsophagotomy for relieving the obstruction, it was determined to attempt to reach a definite diagnosis by means of the X-ray. The child was given an emulsion of bismuth to swallow, and then an exposure was made. In taking this plate, it was impossible to have the head in full extension without causing the patient to reject most of the bismuth, consequently this plate does not show any of the cervical vertebræ. Figure 1 shows the result of this exposure. The bismuth is seen as a mass extending upwards from the left first sternocostal junction. This mass, neither by its shape nor situation, afforded a basis for differentiation between diverticulum and stricture, so it was decided to pass a bougie and attempt to outline the

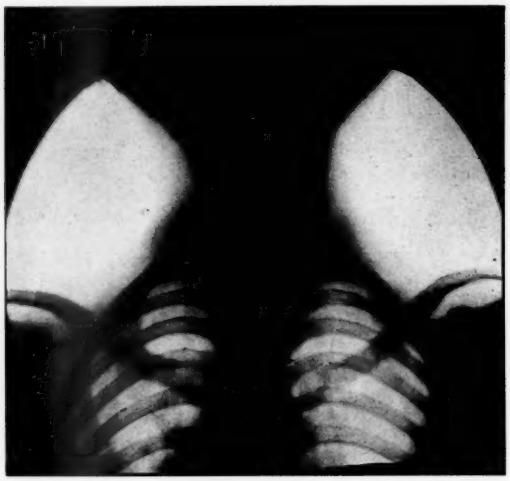

Fig. 3. Fine gold chain marking axis of lumen of œsophagus, and coiled into a mass just above strictured site.

relation of the bismuth mass to the lumen of the œsophagus. The bougie seemed to enter the stomach, but the passage of it caused the patient to bring up most of the bismuth emulsion. Nevertheless, an exposure was made, with the result that when the plate was developed we were surprised to find that the bougie was not in the stomach, but for the most part lay coiled up in the upper part of the œsophagus. Figure 2 is a reproduction of this plate. This picture seemed to us to point to the diagnosis of diverticulum, but yet it was impossible to reach a definite conclusion without knowing the relation of the mass shown in Figure 1 to the lumen of the œsophagus. In order to do this, we had the patient swallow a very fine gold chain about as thick as ordinary wrapping twine. The chain was about two feet long, and of this we allowed enough to be swallowed to fill the sac. Another exposure was now made, and the result is shown in Fig. 3. The chain is seen distinctly coursing down in practically a straight line, from the first cervical vertebra, and ending in a mass well to the left of the middle line. On the basis of this picture, the definite diagnosis of diverticulum of the œsophagus was made, for we reasoned that were the lesion a stricture, the mass of chain would not extend so far to the left of middle line.

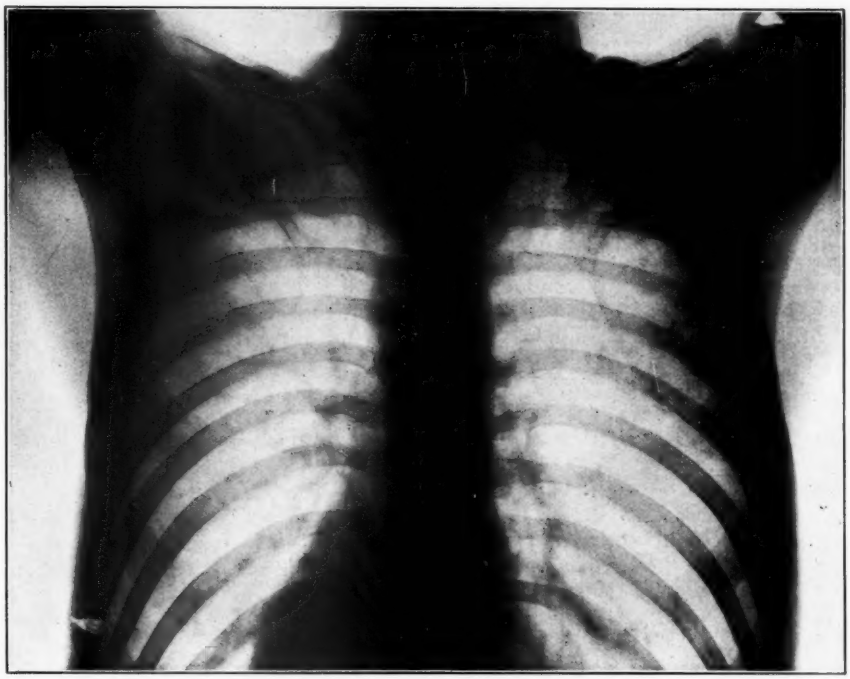

Fig. 4. Heavy dots are shadows of lead shot plastered over the spinous processes; black line is shadow of chain in œsophagus. Demonstrates relation of œsophageal lumen to mid line of body.

In order to clinch matters further, it was decided to note the relation of the œsophageal lumen to the middle line of the body, in a normal individual. The middle line was mapped out by fixing bird shot over the tips of the spinous processes, with adhesive plaster. The chain was then swallowed, and a picture taken with the ray directed perpendicular to the spine.

The result is shown in accompanying Fig. 4, where it will be seen that the lumen of the œsophagus corresponds almost exactly with the midline of the boy. Judged by this picture, the mass in Figure 3 is situated sufficiently far laterally to be construed as a diverticulum. The absence of curves as shown in Fig. 4 seems to be contrary to the ordinary text-book descriptions of the œsophagus, but a series of carefully plotted reconstructions of the human body, made from cross sections by Dr. Potter, formerly of the anatomical department of St. Louis University, show that the œsophagus not uncommonly lies almost in the middle line of the chest.

The operation of external œsophagotomy disclosed that, after all, the lesion was a tight stenosis of the œsophagus, above which the left wall was diverticulated to a marked degree. The stenosis was so tight that the smallest probe could be engaged in the opening with difficulty. The immediate and remote operative results were all that could be desired. The patient is now able to swallow all varieties of food, and she passes once a month the largest size œsophageal bougie.

The object of this paper is chiefly to furnish a method of studying the œsophagus with the X-ray without encountering the difficulties inherent in the use of the bismuth emulsion. It need hardly be stated that so small a chain is swallowed without the slightest difficulty.

For the excellent X-ray technique which has made this work possible, I am indebted to Dr. R. D. Carman, of St. Louis.

THE PATHOLOGY AND CYSTOSCOPY OF CYSTITIS CYSTICA

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CYSTIC formations occurring in the urinary tract have been known to the pathologists for a long time. As a rule they were accidental post-mortem findings, having escaped the clinician entirely, and such is still the case to-day unless a routine cystoscopic examination be made in all cases that present the slightest indication of disturbances in the urinary tract.

As early as December, 1749, Morgagni described cysts occurring in the ureters, found post-mortem, in which the pelves of the kidneys were much dilated and the ureters appeared to contain stones; upon opening them they contained cysts. Rayer described them as eruptions vesiculeuses in 1841.

Rokitansky, under the pathology of the ureter, says cysts appear to be more frequent in the urinary passages than they are in and upon other excretory ducts. They represent cysts the size of millet seeds or peas, developed under the mucosa, and either grouped together or solitary. They contain a colorless or yellowish serous fluid, in which is found a soft gelatinous or hard nodule, varying in size and resembling amber or horn. They are found chiefly occupying the ureters and in one case the pelvis and calyces of the kidneys.

Under pathology of the bladder, Rokitansky says that we have never observed cysts occurring between the coats of the bladder or in its mucous membrane, though from their occurrence in the ureters, pelves, and calyces we are not inclined to dispute the former. Klebs described them as herpes of the bladder.

Not much interest was taken in this subject until the appearance of von Brunn's monograph in 1893. He described the presence of epithelial bodies occurring in the mucous membrane of the urinary tract. Von Brunn classified these bodies into two groups, depending on their relation to the superficial epithelium. The one group he termed "epithelial nests," and they were not connected with the superficial epithelium, but were completely surrounded by the tissue of the submucosa.

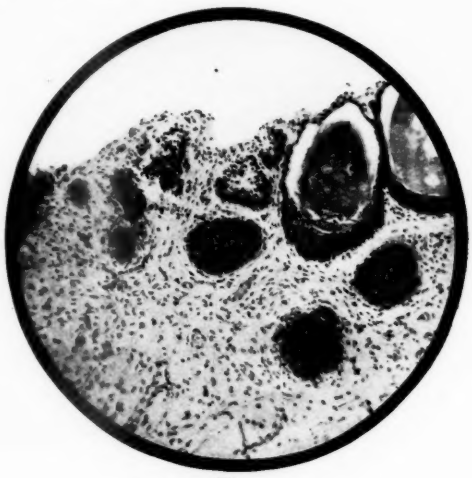

Fig. 1.

As "Epithelzapfen," he described the masses of cells, more or less wedge-shaped, and which were still connected directedly with the superficial epithelium. Von Brunn believes that originally they were all connected with the epithelium, but that this connection has been lost in some of them. He thinks they take their origin from invaginations of the superficial epithelium.

According to von Brunn they cannot be classified as true glands, as they possess none of the characteristics of them, such as an excretory duct, and by the absence of secretory changes, as are usually seen in true glands.

These epithelial bodies present a definite histological picture. If we study these nests very closely, we will note that they are surrounded by a distinct capsule composed of flat connective tissue cells (Fig. 1).

At the periphery of the islands, the cells are usually cylindrical in shape, containing a large nucleus. Here the cells are closely crowded together, with apparently more or less regularity in their arrangement, whereas in the center this regularity is lost and the cells appear more or less polyhedral. Around some of

Fig. 2.

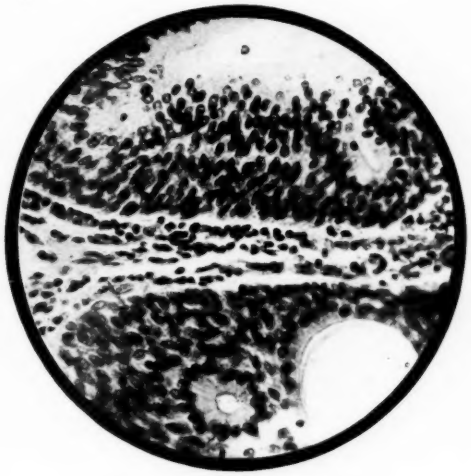

Fig. 3.

these "nests" areas of round cell-infiltration may be seen.

As long as these epithelial bodies are connected with the superficial epithelium they are called "epithelzapfen," which connection can be seen very distinctly (Fig. 2).

These epithelial nests and zapfen do not remain in the above-described state, but undergo a series of changes which result in the formation of cysts. When these cysts are present so that they project above the bladder mucosa, they can be recognized clinically by means of the cystoscope, and this condition is called urocystitis cystica.[1]

The occurrence of distinct gland tubules may be seen (Fig. 3), and sometimes two such formations may be present in the same cell nests. In one area the arrangement of the cells would lead one to come to the conclusion that we were dealing with a third lumen. Upon close observation, however, a distinct lumen cannot be made out, and it appears as though the cells were arranging themselves preparatory to a lumen formation.

This concentric arrangement of the cells may be seen not only in the "epithelial nests," but also in the "epithelial zapfen."

Stoerck and Zuckerkandl, in a recent publication, recognize this arrangement, and they are inclined to believe that the occurrence of the cysts takes place on a secretory basis, and that a part of this process is the concentric arrangement of the cells. "There is to be seen between the epithelial cells of the Limbeck-Brunn nests a round droplet, without any perceptible relation to the neighboring cells, and which are still uninfluenced in their arrangement. This droplet may occur half-way between the center and the basal membrane.

"At a time when the droplet is still small, before there has been any change in its size, the surrounding cells assume a concentric radiating position around the droplet. Soon a second and third layer may be seen beyond the first.

"After the droplet has distinctly increased in size, the innermost layer assumes the characters of a secreting epithelium, characterized by a basal position of the nuclei, the protoplasm nearest the drop becomes light and succulent and often contains fine, evenly distributed, bright granules. The surface of these cells toward the lumen forms a sharp continuous line." (Fig. 3.)

The number of lumina which may be seen in the epithelial nests is variable. Sometimes only one lumina may be seen, and in other sections several may be seen in one nest.

[1] The term "urocystitis" has been used by some writers in describing inflammatory changes in the urinary bladder, so that in this connection the term urocystitis cystica may not be amiss

Fig. 4.

Fig. 5.

Where several lumina occur in one nest a difference in size can be seen in the several lumina, as in Fig. 4, where several small ones occur in the same nest with a rather larger one. Around this nest small round cell-infiltration is to be seen.

The formation of the cysts may take place in the surface epithelium or in the submucosa. A continuation of the secretory process must necessarily result in a distention, with the production of a retention cyst, where the lumina has no communication with the bladder surface. The cystic formations gradually push their way upward, and so reach the free surface of the bladder, above which they project. And it is in this stage that we can recognize the condition by means of the cystoscope.

The gradually increasing size of the cysts is met with at an expense of the lining epithelial cells, so that in some places the cysts are lined with a single layer of very much flattened epithelial cells. It seems as though the cells lining that part of the cyst which projects into the bladder, suffer the most, for in some of the cysts the part of the cyst which projects into the free bladder cavity may be lined by only one or perhaps two rows of cells, whereas that part of the cyst wall still surrounded by bladder tissue may contain eight or ten rows of cells (Fig. 5). The occurrence of very thin-walled cysts and cysts in which the wall consists of several layers of cells is not uncommon.

The contents of the cysts take a very deep stain with eosin and look very much like colloid, being sometimes described as the colloid-like contents of the cysts.

In the early stages the cystic contents are almost colorless or they may have a yellowish color; the fluid is thin, which gradually becomes inspissated, a process not infrequently seen in other cystic formations.

The occurrence of vacuoles is frequently noted in the cyst contents (Fig. 5). Pigment deposits may be seen as well as calcification (Stoerck and Zuckerkandl) and not infrequently desquammated epithelial cells.

The clinically interesting thing about these cystic formations is the fact that they can be recognized by cystoscope. Before describing the cystoscopic picture, it is perhaps well to mention the fact that these same cystic bodies may only be found in the ureter (ureteritis cystica, as in a case recently reported by Bond Stow) or in the pelvis of the kidney. Our finding them in the bladder does not at all exclude their presence in the upper urinary tract.

Cystoscopically they appear as small bodies, varying in size from a caviar to a pea, being more or less globular in shape, and of a yellowish color. In a recent state they are light

colored and quite transparent, but later they become darker in color and less transparent. Sometimes just a few cysts are to be seen, and again at other times the entire bladder may be covered with them. They are most frequently found on the trigone. They may also occur around or near the opening of a bladder fistula, as well as in the neighborhood of a breaking-down neoplasm (Zuckerkandl).

At first sight they might be mistaken for tubercles. This error in diagnosis may be avoided if we will just bear in mind the fact that tubercles are to be found at the seats of branching of the vessels, whereas the distribution of the cysts is independent of the vessels.

They may bear some resemblance to "œdema bullosum," which is often described as appearing like a "bunch of grapes," which condition is not seen in cystitis cystica.

The exact origin of these cysts has been the source of much theoretical speculation.

In a recent publication, Giani reports the accidental production of cystitis cystica, while working with tubercle bacilli which he introduced into the bladders of rabbits by means of a suprapubic cystotomy, the bacilli being contained in gelatin capsules. In a few cases the capsules were passed through the urethra. Those remaining became incrustated with salts, forming large stones which constantly kept the bladder in a state of irritation.

As early as the fifteenth day he noticed changes in the bladder mucosa, in the scar as well as in parts of the bladder remote from the scar. He noticed in the mucosa epithelial budding processes, which later lost their attachment to the epithelium and were found free in the submucosa. These nests finally underwent changes, resulting in the formation of cysts.

In the cysts he also found epithelial cells in a stage of degeneration, resembling sporozoa, and he believes that the so-called parasites described in this connection, were nothing but degenerated epithelial cells.

These same changes he was able to produce by curetting the bladder. In this connection he says that the cysts grow upward, reaching the free surface of the bladder, and that the cysts may finally disappear completely, without leaving any trace of their former presence.[1]

[1] This where the irritation was removed stands in marked contrast to the former experiment where the irritation remained in the bladder

Giani also found the presence of epithelial nests occurring in a middle lobe of a prostate which was removed by operation.

Stoerck explains the origin of the epithelial bodies on an inflammatory basis, and in favor of which he mentions the presence of many subepithelial capillary loops, which he looks upon as the remnants of an inflammatory stage. The capillary loops, according to Stoerck, are found at the site of former areas of infiltration, which resulted in throwing the mucous membrane into niches and folds.

Ebstein, in 1882, said that the occurrence of these cysts is closely associated with the presence of a chronic catarrh of the urinary tract.

Lubarsch bases his classification upon the origin of the cysts of which he recognizes two varieties: 1. Simple degenerationcysts; 2. Cysts with proliferation. In his second group, based on histogenesis of the cysts, he recognizes: 1. Those originating from crypts of the mucous membrane; 2. Those originating from von Brunn's nests; 3. Those springing from misplaced urethral gland tissue.

Litten considers as the primary change a retention of glandular secretion, due to the associated catarrh of the ureteral mucous membrane brought about by the presence of a stone.

Limbeck says the origin of the cysts is to be explained in two ways: 1. By adhering together of the folds of the proliferated mucous membrane; 2. Through a proliferation of the bladder epithelium, which grows into the depths with a secondary central degeneration.

Herxheimer comes to the following conclusions: That the epithelial nests are primarily the result of epithelial proliferation, and that the superficial epithelium and especially in those places where the cell nests are found, possesses a peculiar power of proliferation physiologically so that the smallest amount of injury leads to a proliferation of the epithelium with resulting "nest formation." He does not believe that the irritants (bacteria, chemical poisons) act directly on the epithelial cells, but that they first produce small cell defects in the epithelium and perhaps in the superficial layers of the connective tissue. The injurious factors may occur during intrauterine life, and hence the occurrence of the "nests" in

the new born. As regards the cysts, he says they are the result of degenerative processes in the cell nests.

Hofman records a case in which the pelvis of the kidney contained a stone, the ureter was cystic, and the bladder mucosa swollen and congested.

Eve described the occurrence in the colloid material of ovoid bodies, corresponding in size and appearance to pseudo-navicellæ.

Silcox, in regard to the origin of the cysts, says the vesicles appeared to originate in foci of epidermal cells, the result of a rapid local proliferation, the central cells of these little epidermal nodules becoming granular, and finally undergoing disintegration and liquefaction, and so accounting for the granular contents of the vesicles.

J. Bland-Sutton describes a kidney and ureter which had been preserved as an example of mucous cysts in the ureter. Microscopic perforations showed the presence of psorospermial bodies.

Clark believes in a parasitic origin of the disease, which was made probable by the repetition of similar lesions in three separate parts of the urinary tract, by the resemblance of the large nucleated and the smaller granular corpuscles to certain forms of psorosperms, occurring in the rabbit's liver and to those figured by Virchow in the bat's kidney. In one of his illustrations, two epithelial cells, containing parasites, are to be seen.

Marckwald believes that the cysts are the result of a process of degeneration, and that we are dealing with degeneration cysts, and that they develop from the so-called nests of v. Brunn. The nests and cysts are congenital, but develop for the largest part during extra-uterine life, their number in the individual case bearing a distinct relation to the age of the patient. Contrary to the views expressed by Stoerck and others, he says that neither inflammatory changes nor infection play any rôle in either their development or in their origin.

In 1889, Targett examined microscopically a preparation described in the Pathological Catalogue of Guy's Hospital, of about 1876. He found the submucous tissue thickened by inflammatory changes, and in it are situated the cysts. They possess thick fibroid walls, and contain masses of granular material, scattered throughout which are round or oval spaces of varying size, filled with granular bodies (like nuclei) and detritus. These spaces certainly possess a capsule, and are probably not due to any degenerative change.

Targett believes that they very closely resemble, both in their naked-eye appearance and in their minute structure, psorospermial sacs.

Hadden reports a case of disseminated sarcoma. The right kidney presented peculiar lesions. The Morbid Growths Committee of the Society referred the specimens to Dr. Spencer Cabbold, who is of the opinion that the bodies in question are psorospermial sacs.

Pisenti and von Kahlden may also be mentioned as supporters of a parasitic origin of the cysts.

In conclusion, attention may be drawn to the following facts:

1. Cystitis cystica may occur alone or associated with cystic formations in the ureter and pelvis of the kidney.

2. When these cystic formations occur in the upper urinary tract they escape recognition clinically, but when they occur in the bladder they should always be recognized, as they present a classical cystoscopic picture.

3. There can no longer be any doubt about the importance which continued irritation plays in their formation, which is evidenced by their experimental production as well as by their occurring clinically, associated with such pathological conditions as stone, chronic cystitis, tumors, and around bladder fistulæ.

4. The weight of evidence appears to be rather against than for their parasitic nature.

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A CLINICAL STUDY OF HYPERNEPHROMA, WITH PATHOLOGICAL REPORTS

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SINCE the recognition by Grawitz (1), in 1883, of the adrenal origin of a certain class of tumors arising in the kidney, there has appeared an abundance of literature bearing upon the subject. Grawitz's views were, at first, vigorously opposed by Sudeck (2), Driessen (3), Hansemann (4), Hildebrand (5), and other writers of note, who maintained that these tumors were of endothelial origin and denied the possibility of their relation to the adrenal body or aberrant adrenal tissue. Later studies, however, entirely confirmed the views of Grawitz; so that, at present, we have a well-recognized type of tumor arising from adrenal tissue, which may spring from a normally placed adrenal body, or from aberrant adrenal tissue. The term "hypernephroma", as a designation of this class of tumors, was first employed by Birch-Hirschfeld (6), in 1896, who recognized "typical and atypical, or benign and malignant hypernephromas, and, according to their origin, cortical and medullary forms." This term has come to include tumors of this character occurring not only in the kidney, but arising from adrenal rests outside of the kidney tissue; so that, at present, while it may be said that the histogenesis of these growths is thoroughly established and their pathological anatomy fairly well determined, they are among the most difficult of recognition and their clinical course and symptoms are not well defined.

The importance of early recognizing these tumors is apparent. As a rule, in the early stages they are of a benign nature, and their growth slow; and it may be months, or even years, before they metastasize, or present other signs of malignancy.

It is, therefore, mainly with the hope of adding something to the meager clinical data which we possess in regard to this condition, rather than with the idea of adding to our pathological knowledge, that this series of cases is presented.

CLASSIFICATION OF CASES

Under the general term of hypernephroma are included all tumors arising from adrenal tissue, whether this be at the normal site of the adrenal gland, from adrenal "rests" within the kidney substance, or at remote localities throughout the body. Further classification upon a purely histological basis has been attempted by some pathologists. Thus, Ohlmacher (7) designates a cortical and a medullary hypernephroma, depending upon whether the new growth reproduces the cortex or the medulla of the adrenal. This author reports a case of "malignant medullary hypernephroma." I have been unable to find other cases of this character in the literature, and the

cases reported in this series have the histological appearance of the cortical rather than the medullary portion of the adrenal, with one possible exception. It is probable that the medullary form of growth is extremely rare, but future observations may enable us to develop a classification upon a histologic basis. It seems that we might properly designate, at least clinically, a benign and a malignant form, for it is well known that many of these new growths may exist for years without presenting evidences of malignancy, while others rapidly invade the surrounding tissues and metastasize early; the latter group, however, may represent but a second stage of the former.

Material. The material forming the basis of this report comprises eleven tumors removed surgically, and examined at the Bender Laboratory during the past twelve years, and four autopsy specimens, which have accumulated during a like period of time. In two of the four post-mortem cases the hypernephroma, which was small, occupied the normal site of the adrenal body. Their presence was not suspected during life, the patients having died of some other disease. In the other two autopsy cases the hypernephroma arose within the kidney, in one of which were revealed two definite types of growth — sarcoma and hypernephroma, with metastases of the former growth to the liver. An attempt has been made to obtain, as far as possible, complete clinical histories of the surgical cases and the ultimate results in each instance.

These tumors may be divided as follows:

1. Hypernephroma (or adenoma) of the adrenal body (non-malignant), 2 cases; in one instance the growth was bilateral.

2. Hypernephroma of the kidney (hypernephroma renis), 9 cases.

The two case of adrenal hypernephroma (adenomata) were discovered at autopsy. In one case (Bender Laboratory Records, autopsy No. 0-848), that of a woman aged 60, death was due to chronic diffuse nephritis and thrombosis of the superior longitudinal sinus. The right adrenal measured 4 x 4.5 x 1.5 cm., and within its medullary portion was an oval yellowish mass, measuring 1 x 2 x 2 cm., surrounded by well-defined adrenal cortex. The mass was apparently a small adrenal tumor. Its cut surface was greyish-yellow in color. Microscopical examination showed the tumor to be composed of adrenal tissue.

The other case was one of dementia paralytica (Bender Laboratory Records, autopsy No. 0-497). Male, age not stated.

Anatomical diagnosis. Arteriosclerosis of aorta, iliac, and coronary arteries. Brown atrophy of heart, with slight interstitial myocarditis (papillary muscles). Senile emphysema of lungs with healed tuberculous foci and acute bronchopneumonia. Slight chronic passive congestion of liver. Bilateral hypernephromata (adenomata) of adrenals. Here both adrenals showed the presence of new growths, the one in the left small, but in the right the growth forms a distinct nodule 8 mm. in diameter, which is composed of yellow, cortical substance.

In neither of these cases do the records show that the adrenal growth presented any symptoms during life which could be attributed to their presence. They are reported in this connection only to complete our series.

Hypernephroma renis. Nine cases. Surgical seven, autopsy two. During twelve years, in which time 1,200 autopsies have been performed at the Bender Laboratory, we have encountered but two instances of hypernephroma having its origin within the kidney. While I have been unable to obtain any clinical data of these cases, the pathological reports seem of sufficient interest to warrant recording.

CASE 1. Autopsy by Dr. Blumer (Autopsy Records, autopsy No. 11). Only a partial autopsy was made about 36 hours after death. Aged male.

Adrenals. Normal.

Right kidney. Capsule strips off with some difficulty, tearing away small pieces of kidney substance. The surface shows well-marked fœtal lobulations. It is finely granular and somewhat congested. At one point, a cyst the size of a walnut, and containing clear fluid, projects from it. On section, the cortex is considerably diminished. Cortex markings indistinct. Glomeruli visible and pale. Medulla congested, but otherwise normal. Pelvis normal.

Left kidney. The position of the left kidney is occupied by a mass the size of two fists. It has, in general, a kidney shape. Its surface is coarsely lobulated, and is adherent to the surrounding structure by firm adhesions. Its consistence is moderately firm. On section, it presents a mottled appearance. Its main bulk is made up of a greyish-white, translucent, homogeneous

structure. Here and there, are areas of this structure which have taken on a greenish color, presumably the result of degeneration. This appearance varies from greenish to a dry, chrome yellow, the tissue in the latter event resembling very strikingly the appearance of the cortical adrenal substance. The adrenal gland on the same side is attached to the tumor mass, but apparently not invaded by tumor substance. At one point is an area, some 3 cm. in each direction, lined by smooth, mucous membrane. This lies in the part of the tumor which corresponds to the hilum of the kidney, and is presumably the remains of the pelvis. Considerable portion of medulla of kidney remains unchanged, growth springing from cortex.

Aorta shows extensive atheromatous changes, with marked calcification.

Liver. The organ has a peculiar shape. Right lobe is much elongated in downward direction. Left lobe is very small. Surface is free from adhesions, a brownish-red color. Scattered over the surface are a number of yellowish, slightly elevated nodules, varying in size from a pea to a marble. On section, the organ is somewhat cloudy. Nodules seen on the surface are found to extend into the substance of the organ. The depth of their extension generally corresponds to their surface diameter. Scattered through the substance of the organ in its depths are a number of similar nodules. On section, they have a homogeneous, whitish-yellow, translucent appearance. The walls of the gall-bladder are thickened. It contains small amount of thick, mucus-like material and three or four dark, facetted gall-stones the size of marbles.

Anatomical diagnosis. Primary sarcoma of left kidney. Metastases to liver and retroperitoneal glands. Chronic diffuse nephritis with cyst formation. Cholelithiasis. Hypertrophy of the prostrate. Contracted bladder. Atheroma of aorta.

THE TUMOR

The tumor presents, in different parts of its substance, two entirely different structures. In places one type predominates over a large area; in places the other type predominates over a large area; while, in still other places, the two adjoin each other, the one apparently invading the other, as will be described below. The one type of tumor presents the following appearances: Under the low power, it is apparently made up of a series of fairly regular spaces, having thin walls, and containing a few scattered nuclei. Under the high power, it is seen that the walls of these spaces are made up of fine bands of connective tissue. The spaces are lined, in some places, by flat cells similar to those lining those of normal blood or lymph vessels. The scattered nuclei, which were seen with the lower power in the spaces, can now be made out to belong to large, exceedingly pale cells, which fill the spaces, and which are apparently proliferated endothelial cells. At no place in the section, which is an alcohol-hardened one, can red blood corpuscles be seen, notwithstanding the fact that their shadows can easily be made out in the adjacent vessels. At one or two places in the tumor

Fig. 1. Case 1. Photograph of multiple hypernephromata of kidney. ½ actual size.

spaces are objects which suggest shadows, and, in an occasional space, the polynuclear leucocytes may be seen. There are distinct blood-vessels running through the tumor, but no connection can be made out between them and the spaces. Although the tumor presents all the appearances of an angiosarcoma, it seems probable that it sprung from the lymph and not the blood vessels.

The other type of tumor, present in the growth, is made up of cells without any definite arrangement, between which run irregular bands of connective tissue. The cells in this growth vary considerably in size and appearance. Taken as a whole, they are large cells. Their shape varies, some being round, some oval, and many of them quite irregular. The amount of protoplasm varies, some showing but a narrow rim, while in others the amount is great. The nuclei have a peculiar refractive look, and the chromatic network is very sharply marked. Scattered throughout the tumor are quite a number of multinucleated cells, many of which are large enough to deserve the name giant cell, and some of which have distinct budding nuclei, such as are seen in certain cells of the bone marrow. Where the two types of tumors meet, one gets the impression that the angiosarcoma is being invaded by the other growth, and the invasion is apparently taking place by the progression of the latter along the connective tissue of the former.

Liver. Outside of the metastasis to be described later, the liver shows areas of localized dilatation of the blood-vessels (probably from pressure of tumor nodules), a swollen and granular condition of the liver cells, and occasional fat spaces. The tumor metastasis, which causes a certain amount of compression of the surrounding liver substance, resembles the second type

Fig. 2. Case 1. Photograph showing hypernephroma invading vena cava. ½ actual size.

of growth described. The cells, however, do not differ nearly so much in size as they did in the original growth, nor are there present any such number of the large multinuclear cells, or of the cells with budding nuclei. In fact, both of these latter are almost absent.

Kidney, for some reason, stains very poorly. Capsule absent. Occasional areas or new-formed connective tissue in center and few similar areas in kidney substance. Most of the glomeruli normal. Here and there, an atrophied one is seen. Kidney cells swollen and granular. Blood-vessels show well-marked obliterative endarteritis. Occasional hyaline cast is seen in tubules.

Case 2. Autopsy by Dr. Pearce (Autopsy Records, No. 1147). Male, 60 years of age.

Abdomen. A small amount, about 300 c.c., of clear, straw-colored fluid is found in the pelvis. Appendix normal. Mesenteric lymph-nodes normal. In the left flank is found a large, lobulated mass, corresponding to the position of the kidney, and adherent to the adjacent structures.

Right kidney. Smaller than normal. Capsule peels readily, leaving a coarsely granular surface, with here and there a few small cysts. Cortex is greatly diminished, being less than one-half the normal amount, and is firm and greyish-red in color. Pyramids are injected. In the pelvis is an increased amount of fat. On the surface of the kidney, and projecting from it as a globular mass, is a tumor 2 cm. in diameter, of soft consistence, uniformly yellowish in appearance, and distinctly encapsulated.

Left kidney is similar in appearance to right, but adherent to and involving its upper pole, is a bilobed mass, twice the size of the kidney itself, which is soft and fluctuant and suggests the presence of cysts. On section, however, these masses are found to consist of a new growth, which has become completely necrotic and which presents in part a uniform, rather firm, yellowish, necrotic tissue, and, in part, soft, red, grumous, material mixed with old blood. The position of the tumor, which is distinctly encapsulated and separated from the kidney substance, although it impinges upon the kidney, presents here and there small portions of tissue which have not undergone necrosis and which indicate it to be of adrenal origin. Moreover, the adrenal on this side cannot be found.

Anatomical diagnosis. Arteriosclerosis. Chronic diffuse nephritis (interstitial type). Fatty transformation of the myocardium. Large necrotic hypernephroma involving left kidney. Small hypernephroma of right kidney. Subacute œsophagitis. Chronic congestion of liver. Emphysema of lungs. Moderate hydroperitoneum and hydrothorax. Malformation of sternum (old fracture?).

Microscopic diagnosis. Chronic interstitial nephritis with hyaline degeneration. Subacute œsophagitis. Papillary adenoma of kidney. Necrotic hypernephroma.

SURGICAL CASES

Case 1. Male, aged 58, was admitted to my service in the Albany Hospital, October 10, 1907. His family history was unimportant. He states that he has always been in good health till the onset of the present trouble, which began seven years ago. At this time, while picking fruit in a tree in a strained position, he felt something "give way" in his right side. The sensation was so noticeable that it was mentioned to his wife. Two days later, blood appeared in the urine, and persisted for two or three days, but was not accompanied by pain. The patient experienced no trouble for a year and a half, during which time he felt perfectly well, when there appeared a second attack of hæmaturia of greater severity than the first and its onset was accompanied with colicky pain and chills, the pain radiating from the back to the perineal region and penis. The flow of blood was so profuse that clots obstructed the urethra and catheterization was necessary. This attack continued for about a week, when there was complete cessation. From this time until about six months ago (4½ years), the attacks of hæmaturia recurred at intervals of four or six months, each time lasting from two days to a week. During the last six months they have occurred more frequently. From frequent catheterizations the patient has developed a severe cystitis. During the last year he has lost about 10 lbs. in weight.

Physical examination. The patient is a strong, muscular man, well nourished, with a slightly sallow complexion. The superficial arteries show no signs of sclerosis. Pulse 80, strong and regular. Examination of the heart and lungs gives no evidence of disease of these organs. There is a decided fullness in the right flank below the costal margin where, on palpation, a tumor, measuring approximately 10 x 18 cm., can be made out. It occupies the lumbar region and extends forward to the nipple line. It moves slightly with respiration. It presents a smooth, anterior surface, and suggests in its shape and position a tumor involving the kidney. A skiagraph was made and at about the center of the tumor mass a small shadow, about the size of a pea, was seen, which was interpreted as revealing a small kidney stone. In view of the history and X-ray findings, a clinical diagnosis of cystic kidney was made.

Urine examination. Sp. gr. 1018, acid, no sugar, trace of albumin, pus and epithelium abundant.

Operation, Oct. 12. Chloroform and oxygen. Lumbar incision. Kidney was found adherent to the surrounding fat, from which it was separated with considerable difficulty. On account of its size, the mass could not be delivered until the incision was extended well forward along the ilium. The pedicle of the kidney was clamped and the organ removed. On account of the extensive involvement of the vessels by the new growth, their ligation was impossible. Clamps were left in situ. Several large gauze wicks were carried down to the stump of the renal pedicle, and the external wound partially closed with interrupted silk-worm gut sutures. Salt solution 1,000 c.c. were given subcutaneously. There was considerable operative shock, but the patient responded well to treatment, and his condition after 12 hours was good. During the first 24 hours following the operation, only 3½ ounces of urine was obtained per catheter. By the employment of diuretics and the introduction of large amounts of saline solution, the daily output of urine was gradually increased, so that on the sixth day after the operation 38 ounces were obtained, which had a fair specific gravity, but contained a large amount of albumen. The patient early developed symptoms of uræmia and died on the seventh day after operation.

Pathological report (Bender Laboratory Records, Surg. Path., No. 07-1348. See Fig. 1).

Gross description. Specimen consists of a kidney, measuring 14 x 8.5 x 7.5 cm. Outer surface is very irregular, in places of a nodular character. It is throughout the greater part mottled greyish-red in color, nodules being bright yellow. At hilum these nodules are more marked, and a mass measuring 4 cm. in diameter, apparently having its origin in the pelvis, is present beneath the capsule. These nodules vary in size, from pin point to the above mentioned. Some are solitary, while others are conglomerate. On section, the pelvis is considerably dilated and distorted and, in part, the calices are obliterated. Cut surface of the kidney substance shows it to be pale greyish-brown in color, and anatomical markings are obliterated. Distributed throughout are numerous, slightly elevated, yellow areas of various shapes and sizes. These nodules are somewhat firm, but one has broken down and presents slight hæmorrhage. About some of these nodules the tissue is dark brown, due to old hæmorrhage.

Anatomical diagnosis. Multiple hypernephromata of kidney.

Microscopic description. Sections of kidney. The entire cortex and medullary portions are extensively replaced by connective tissue, the greater portion being composed of young cells. Many tubules are compressed and obliterated, some containing hyaline casts and denuded of epithelium. Others are dilated. Many glomeruli are partly or entirely replaced by fibrous connective tissue and the capsules greatly thickened. In the section are areas of cuboidal cells which stain poorly and contain fat globules. These nuclei are found and show no definite arrangement. About them the connective tissue is fibrous and contains considerable free blood and pigment.

Microscopic diagnosis. Hypernephromata of kidney.

Autopsy by Dr. Hacker (Bender Laboratory Records, autopsy No. 1188).

Anatomical diagnosis. Absence of right kidney (due to operation). Incised wound of right side, with necrosis (due to operation). Hypernephroma of perinephritic fat (right side), with invasion of inferior vena cava. Chronic interstitial nephritis. Cholelithiasis. Hydroperitoneum. Hydrothorax. Hypostatic congestion of left lung. Emphysema of lung. Anthracosis of lung.

Kidneys. The left kidney is enlarged and measures 11 x 6.3 x 5 cm. The capsule, in places, is adherent. The surface is pale and presents numerous points of retraction. Beneath it are occasional cysts, the largest 1 cm. in diameter. The cut surface is pale and opaque. The cortex is thickened and markings are indistinct. Numerous cysts are present, and at the lower pole in one pyramid is a circumscribed, soft, brownish-yellow nodule 1.2 cm. The right kidney is absent. In the right renal region the tissue is infiltrated by blood and necrotic material. Behind the right renal vein is a soft, friable mass, measuring approximately 5 x 3 x 2 cm. The portion bordering on the wound is soft, pinkish-brown, but anteriorly it is soft and bright yellow. The latter penetrates the posterior wall of the inferior vena cava and forms a pedunculated mass, which fills the lumen and extends into both renal veins (See Fig. 2). This mass is soft, bright yellow, and freely movable about the pedicle. It measures approximately 4 x 3 x 1.8 cm. About 4 cm. from the inferior vena cava, the right renal vein presents a small, bluish-brown, eroded area.

Microscopic description. Right kidney. Throughout there is an irregular increase of connective tissue and beneath the capsule are areas composed chiefly of small, round cells. In the cortex, many of the tubules are lined by swollen and granular cells, which entirely fill their lumina. Toward the pelvis, many are contracted and filled with hyaline material. Others are

dilated. The lumina of many tubules are filled with desquamated epithelium. Many cells contain fat globules. Many glomeruli show proliferation of young connective tissue, some of which are entirely transformed into fibrous tissue with hyaline degeneration. The veins are engorged and dilated. The arteries show thickening, chiefly the intima, while many capillaries show obliteration with hyaline transformation. At one point is an area composed of processes of fibrous tissue covered by cuboidal cells, many of which have a brown granular material. In places these processes have undergone necrosis. Within the necrotic material are numerous blood corpuscles, pigment, and cholesterin spaces. About this area is a dense, fibrous capsule in which are a few spaces lined by a single layer of cuboidal cells. The nuclei of these cells are round and stain deeply. In the region of this area are several cysts containing a mucoid substance. These cysts are lined by a single layer of low cuboidal cells. Throughout many sections are occasional small areas filled with densely packed, irregularly arranged cells, which resemble in structure those in the area above described. The arteries show marked thickening of the intima and the capillaries show increase of connective tissue, with hyaline transformation and obliteration.

Left adrenal. Irregular areas are composed of cells showing marked infiltration of glycogen. The capillaries show marked thickening with hyaline transformation. Many are obliterated.

Right adrenal. Similar to left.

Retroperitoneal mass at base of wound. The greater part is composed of large cells having a tubular arrangement and in which are globules of glycogen. The greater part of the tissue is necrotic and the capillaries are distended with colonies of bacteria. In part, the necrotic material is markedly infiltrated by polynuclear leucocytes. The remaining tissue is œdematous and contains many leucocytes.

Microscopic diagnosis. Hypernephroma of lumbar region, with necrosis and suppuration. Hypernephromata of right kidney. Chronic interstitial nephritis. Chronic myocarditis. Chronic passive congestion of lung, liver, and spleen. Arteriosclerosis. Chronic cystitis. Slight chronic pancreatitis. Acute bronchopneumonia. Anthracosis, emphysema, and atelectasis of lung. Encapsulated papillary adenoma of right kidney.

CASE 2. Service of Dr. MacDonald. Mr. T. S., aged 46 years. Duration of disease six months, following a fall in which he was struck in the region of the right kidney. Symptoms of onset, pain, originating in right lumbar region and referred downward to penis, hæmaturia accompanying the pain. Recurrent attacks for six months.

Clinical diagnosis. Stone in kidney.

Operation. Removal of right kidney.

In February, 1908 (5½ years after operation), patient was in good health.

Pathological report (Bender Laboratory Records, Surg. Path. No. 97-14), September 4, 1902.

Gross description. Specimen consists of a kidney measuring 5 x 2 x 1.5 inches. The fatty and fibrous capsules have both been removed, leaving a smooth, mottled surface. The prevailing color of the surface is yellowish-brown, the mottling being due to numerous pin-head areas of hæmorrhage. The upper pole of the kidney is enlarged, and there are present on the surface of the enlarged portion a number of yellowish tumor nodules, covering from $\frac{1}{16}$ to $\frac{3}{8}$ of an inch in diameter. These nodules are rounded, soft in consistence, and smooth, and are of yellowish color. On section of the kidney, the main portion of the organ is relatively normal. The cortex is slightly swollen and quite pale. Glomeruli congestive. The pelvis shows a number or discrete and confluent hæmorrhages. The tumor nodule measures an inch and five-eighths in diameter. It is roughly globular and occupies one pole of the kidney and projects into the pelvis. One point of the tumor is soft, and in places distinctly hæmorrhagic, and is made up of a yellowish cellular growth, which has the appearance of adrenal tissue.

Anatomical diagnosis. Hypernephroma of the kidney.

CASE 3. Service of Dr. Vander Veer. Mr. G. W., aged 35. Complains of tumor in the left abdominal region. Onset five years ago, with pain in the region of the tumor. Attack lasted three days. Ten days ago, first noticed a bunch in left side of abdomen, which has increased some in size since then. Patient has lost in weight and feels perfectly well. Urinary examination showed granular, hyaline, and epithelial casts, some mucus, some epithelia, clear amber, sp. gr. 1020, no sugar, trace of albumen.

Clinical diagnosis. Sarcoma of kidney.

Operation, May, 1905. Removal of left kidney. In November, 1907 (2½ years since operation), patient was well. Had gained 15 lbs. in weight. Urine was normal. No evidence of metastatic or recurrent growths.

Pathological report (Bender Laboratory Records, Surg. Path., No. 05-537):

Gross description. Specimen consists of a kidney, from the cortex of which projects a definitely encapsulated cystic tumor, measuring from 12 to 16 cm. in diameter, and having a base measuring 10 x 3 cm. The center of this base corresponds to a point situated on the surface of the kidney, opposite the hilus and at a point corresponding to the junction of the upper and middle thirds. On section, the tumor is found to have a firm, fibrous capsule, averaging from 3 to 5 mm. in thickness, and a softened center, consisting of a grumous, blood-stained, necrotic-looking material, with coarse tags of fibrous tissue extending in from the wall of the cyst. The cyst extends into the kidney as far as the pelvis and the kidney cortex is reflected over the surface of the tumor, for a distance of 4 to 5 cm., at the base. The remainder of the kidney shows nothing noteworthy. The general picture is that of a tumor, originally composed of large, cellular areas and coarse interstitial fibrous bands, which has undergone extensive necrosis.

Anatomical diagnosis. Hypernephroma with extensive necrosis and softening.

Microscopic description. Sections show capsule composed of dense fibrous tissue with areas of calcification and true bone formation. The contents of the cyst are, for the most part, almost completely necrotic, but immediately adjacent to the capsule, and partly infiltrating it, can be seen irregular islands of large, polyhedral, vacuolated cells having the general characteristics of adrenal cells. These cells are arranged in irregular masses, and, in some areas, have an indefinite, glandular arrangement. In other sections, newformed blood-vessels can be seen extending from the capsule into the necrotic, hæmorrhagic cysts contents.

Microscopic diagnosis. Adrenal tumor with extensive central necrosis and softening and hæmorrhage, together with calcification and bone formation in capsule.

CASE 4. Service of Dr. Madill, of Ogdensburgh, N. Y. Mrs. K., aged 33. Duration of disease about 5 months. Symptoms anæmia, loss in weight, and pain of a dragging character in the region of the left kidney. No urinary symptoms (patient had suffered from neurasthenia for over a year, and the tumor of the kidney was discovered while making an examination).

Clinical diagnosis. Tumor of kidney.

Operation. Nephrectomy, left.

Recovered from operation rapidly and improved for about four months. Then again became anæmic, lost weight, and died ten months after operation (definite cause of death not known. No evidence of recurrence or metastases).

Pathological report (Bender Laboratory Records, Surg. Path. No. 06-55).

Gross description. Specimen consists of a large, distorted kidney. Capsule strips fairly readily from one pole, which measures 7 x 6 x 3 cm. Opposite pole is enlarged by a circular tumor mass so that it measures 10 x 7 x 5 cm. Entire kidney is about 13 cm. in length. Mass is 6 cm. in diameter. Kidney substance is normal in consistence, except over mass, where softened areas are felt. Considerable amount of fat is found in pelvis. Over tumor, color is a reddish to a yellowish-white. Remainder of kidney is pale, and dark reddish-white in color. Cut surface shows the tumor mass to be well encapsulated, yellowish-white in color. Several areas of hæmorrhage near periphery. The remainder of tumor surface contains scattered areas of increased consistence and waxy appearance. In the remainder of the kidney, cortex and pyramids are very pale. Pelvis contains a large amount of fat. Malpighian corpuscles are seen.

Anatomical diagnosis. Adrenal adenoma arising in kidney.

Microscopic description. Section of kidney and tumor mass shows tumor surrounded by a compact layer of kidney pulp, beneath which and in body of tumor are found areas of hæmorrhage. Tumor is made up of a fine, reticular stroma, in which are large epithelioid cells with vesicular nuclei. Cells are arranged in cords and masses. Protoplasm does not stain well, is translucent and vacuolated, and contains a few granules. Many large areas of necrosis occur, accompanied by infiltration of leucocytes and lymphoid cells. Renal tissue proper shows cloudy swelling of tubular epithelium.

Microscopic diagnosis. Adrenal adenoma.

CASE 5. Service of Dr. Van Loon. Mrs. D. Z., aged 52. Family history negative. Patient has had attacks of "stomach trouble" for several years. One week ago, a definite attack of biliary colic. Upon examining the abdomen at this time, a tumor of the right kidney was found. Urinary examination negative.

Clinical diagnosis. Gall-stones, tumor of right kidney.

Operation, May 11, 1907. Cholecystotomy, removal of gall-stones, nephrectomy, right kidney and tumor. Good recovery. In February, 1908 (8 months after operation), patient was well.

Pathological report (Bender Laboratory Records, Surg. Path. No. 07-670).

Gross description. Specimen consists of a pyramidal-shaped mass, measuring approximately 18 x 12 x 8 cm. through its broadest diameters. The mass is encapsulated and the broader half is greyish-yellow and soft, while the remaining portion is firmer and greyish-brown. On section, the cut surface of the soft portion is pale, brownish-yellow, and pulpy; from it there exudes a brownish-pink fluid. The remaining portion, on section, presents the cut surface of a kidney. The two portions gradually fade into each other.

Anatomical diagnosis. Hypernephroma of kidney.

Microscopic description. Sections show trabeculæ and gland-like spaces, composed of polygonal or cuboidal cells, arranged in an irregular manner. In parts necrosis is seen and extensive hæmorrhage.

Microscopic diagnosis. Hypernephroma of kidney.

CASE 6. Service of Dr. Macdonald. Mr. D. J., aged 49. Clinical history not obtained. Patient died 24 hours after operation.

Pathological report (Bender Laboratory Records, Surg. Path. No. 04-860).

Clinical diagnosis. Sarcoma of left kidney.

Gross description. Specimen consists of a much enlarged and degenerated kidney which has been bisected. Each half measures about 16 x 12 x 3 cm. External surface of one half is smooth and glistening. The other surface is uneven and denuded of covering in places. On section, find but little evidence of normal kidney tissue, and that is near periphery. Surface, as a whole, presents a necrotic, honey-combed appearance. Strands of white, fibrous tissue, fairly hard to feel, radiate in all directions. These areas are intermingled with yellowish patches, some of them being necrotic and filled with cheesy-like material. In still other places, the surface presents a pearly-white appearance. Some evidence of hæmorrhagic areas in cortex, there being a few blood clots.

Anatomical diagnosis. Hypernephroma of kidney.

Microscopic description. Large masses of cells with round, lightly staining nucleus and large amount of protoplasm, which is greatly vacuolated and resembles the structure of adrenal cells. Between these masses

are large bands of more or less hyaline connective tissue. Some portions of tumor are entirely necrotic.

Microscopic diagnosis. Hypernephroma.

CASE 7. (From Ellis Hospital, Schenectady, N. Y.) I have been unable to obtain any clinical history of this case other than that which was appended to the specimen upon its receipt at the laboratory. It was said to be a left kidney which had been growing for seven years; patient suffered from intermittent hæmaturia.

Pathological report (Bender Laboratory Records, Surg. Path. No. 04-1054).

Gross description. Specimen consists of an oval tumor mass, measuring 24 x 17 x 14 cm. The surface is roughly lobulated and covered with coarse tags of fibrous tissue, the entire mass having a firm, fibrous capsule. On section, the mass is seen to consist of multiple globular, usually definitely encapsulated, tumor masses, ranging from 1 to 4 cm. in diameter. These masses are separated from one another by firm sheets of fibrous tissue which retract on section. The non-degenerated portions of the new growth present a light pink, distinctly granular, cut surface; others are softened and present a yellowish, fatty-like surface; while others are hæmorrhagic, and a few are represented by cavities filled with a hæmorrhagic fluid.

Anatomical diagnosis. Hypernephroma.

Microscopic description. Sections show stroma of connective tissue imbedded in which are large polyhedral cells, lying in irregular columns. These cells show marked vacuolation, with some pigmentation resembling adrenal cells.

Microscopic diagnosis. Adenoma of kidney with cells resembling adrenal cells (hypernephroma).

SYMPTOMATOLOGY

The four cases reported from out autopsy records did not present, as far as can be determined, any symptoms attributable to the hypernephroma. The clinical history of one of the surgical cases was not obtainable, leaving us only six cases on which to base our clinical data. The symptoms of importance, which were fairly constant, were three in number, *pain, hæmaturia* and *tumor*. Pain was present in four of the six cases, in three of which it was of the type described as renal colic, and was accompanied by hæmaturia. Without doubt, the pain in these cases is due to the passage of blood clots from the pelvis of the kidney to the bladder. In the fourth case, the pain was confined principally to the region of the tumor, and radiated backward to the spinal column. The most frequent form of pain, then, is that accompanying the hæmaturia, and it differs in no way from that caused by the passage of other foreign bodies along the ureters. It is usually not as severe in character as that produced by calculi. The hæmaturia, if slight in amount, may occur without pain. It is frequently the first symptom noticed. In all of our observations it was intermittent in character, lasting from a few hours to several days, and appearing at intervals from a few months to several years. In one case, the hæmorrhage was usually very profuse, often filling the bladder with clotted blood and obstructing the urethra.

Apparently the size and location of the growth within the kidney substance had little bearing upon the occurrence of this symptom; for, in two instances where the pathological examination showed the tumor to be of large size and to involve the renal pelvis, there had been no hæmaturia. A tumor that is easily palpable, or that the patient discovers, is necessarily a late symptom and, if one on which we rely to make a diagnosis, often appears too late to offer our patient a good chance of recovery.

Location. In six of the ten cases of hypernephroma of the kidney, the tumor was found upon the left side.

General symptoms are usually absent in the early stages. With prolonged and severe bleeding, secondary anæmia is marked, and the patient may lose considerable weight In one case the condition was associated with neurasthenia.

Aside from the presence of blood, there were no significant urinary changes. One case had a severe cystitis, probably from catheterization, and in two there were evidences of a chronic nephritis, albumen, and urinary casts.

Age. The youngest patient was 33, the oldest 60 years; average age 48 years. The average age of onset, as indicated by the appearance of symptoms, was 41 years.

Sex. In one case, the sex was not stated. In six cases, it was found four times in the male and twice in the female.

Duration. It is obviously difficult to ascertain, even approximately, the length of time that many of these tumors have been present. In two of our cases, while the growths had attained large size, they had presented no symptoms which attracted the attention of the patient, and they were discovered by the physician upon examination. It is only in those

cases, in which hæmaturia and pain are manifest, that we can base any accurate knowledge of the length of time which the tumor has been present. I think it may be said that, almost without exception, this type of growth is slow in progress, especially in its early stages, and attains palpable size only after several years of existence. In two cases in this group hæmaturia had been present for seven years. Tumors presenting symptoms for shorter periods of time, gave no indications, histologically, of being of a less malignant type.

Diagnosis. Unfortunately these tumors of adrenal origin, whether arising within the kidney substance or at the normal site of the adrenal body, present no pathognomonic symptoms. For a diagnosis we are largely dependent upon three symptoms, *hæmaturia*, *pain*, and *tumor*, which are alike suggestive of other and more common kidney lesions. As far as I am aware, those growths arising outside of the kidney never present symptoms, except tumors and, perhaps, metastases, both of which are necessarily late manifestations. It may be said that rarely is a correct diagnosis of hypernephroma made previous to operation. This is unfortunate, since it is clearly demonstrated that these growths, at least the majority, are of a benign character in their early stages, and that, when thoroughly removed at this time, they show no tendency to recur. It seems that, clinically, we may recognize two groups of *hypernephroma renis*: Cases associated with hæmaturia; and cases without. Obviously, the cases without hæmaturia present no early symptoms whatever suggestive of renal lesion, so that in this group, *tumor* and, rarely, pain are the first manifestations. This was true in three of our six cases. in all of which the growth had attained considerable size. In one of these cases, death occurred within a few days after operation, and in another, after a few months. In this latter case, while it was not demonstrated that death was due to metastases, this seemed to the surgeon to be the probable explanation. In the other group of cases where hæmaturia is present we are given a clue to the condition, and by a process of exclusion we should be able, at least, to make a tentative diagnosis of hypernephroma. An exploratory operation should then be done. Three of cur cases had hæmaturia early in the disease and in each instance it was associated with "colicky" pain. In a study of the cases collected by other observers, we are led to believe that *hæmaturia* and *pain* are present more frequently than indicated by our series. Thus, Keen and Pfahler (8) found hæmaturia in nineteen out of twenty-six cases. Cases, then, presenting the symptom of hæmaturia should always be approached with this possibility in mind, and we should exhaust every means at our command to confirm or exclude hypernephroma. A question in regard to these cases, which has never been thoroughly investigated, is that of increased arterial tension. It is logical to suppose that, with an increase of adrenal tissue, we may have an excess of adrenal secretion, which would result in a rise of blood-pressure. Certain writers have noted that this was true; but observations upon this point, sufficient to settle the question, have not yet been made. Every case of hypernephroma should be thoroughly investigated in this regard, and we may find that a study of the blood-pressure furnishes us a valuable aid in diagnosis.

Prognosis. I think is can be safely said that, in the majority of cases of hypernephroma, an early removal of the tumor will result in a complete cure. Three of our six cases operated upon are still living and in good health; in one instance 5½ years have elapsed since operation. One case has been lost sight of.

Metastases of the hypernephromata are not uncommon, although it was not observed in any of the cases of our series. In Case 1, there was a direct extension of the growth through the renal vein into the vena cava. The usual mode of metastasis is through the blood-stream by way of the renal vein, and this takes place usually in the later stages where there is extensive local invasion. The metastases, therefore, are found most frequently in the bones, lungs, and liver. Scudder (9) has recently recorded four instances of bone metastases and refers to eleven other cases in the literature, making fifteen in all, the majority of which were fatal. Rarely, extension may occur through the lymphatics. Stober (10) reports a case of hypernephroma of the left

adrenal with metastases to the mediastinal lymph glands. I have been unable to find other similar instances in the literature.

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A CRITICISM OF THE TREATMENT OF ACUTE SUPPURATIVE INFECTIONS BY PASSIVE HYPERÆMIA AND CUPPING AS ADVOCATED BY PROFESSOR BIER

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HE who has followed the German literature during the last two or three years must realize that in Germany the treatment of acute suppurative infectious diseases, as advocated by Professor Bier, is generally acknowledged. The smaller voices of criticism which have openly appeared (Lexer, Thöle, Wrede) have been drowned by the larger number of praisers who have in part become followers of that method of treatment.

However, one does not forget that we have to deal with an empirically recommended agent which, in the light of scientific research, shows many unexplained contradictions; also that it would be well to consider with care the worth of the method rather than be misled by the general enthusiasm.

Since so much has been written about the Bier treatment, I will presuppose a knowledge and familiarity with it and challenge Bier's monograph "Hyperæmia as a Curative Agent"(1).

Bier holds that the infections of the body are overcome by inflammation and the good which he seeks is the augmentation and increase of the inflammation. I have already pointed out that the inflammation is not the weapon of the body against the bacteria, but rather the phenomena of the complete reaction of the body to the organisms(2). Inflammation is a complex of single phenomena, the one in which the body is prepared to withstand injury, but we must differentiate it from the other: the injury to the body by the bacteria. It is a reaction of the body according to natural laws and not merely a preparation to repel, which must be considered as a purely useful measure.

The significance of this plea lies in its practical conclusions. It cannot, according to my comprehension of inflammatory processes, *be right to increase the inflammation beyond a certain limit, since it otherwise takes with it an undesirable concomitant*, namely, injury to the body which is pointed out by simple consideration. If one considers, for instance, the changes in the circulatory system caused by infection, we see that the blood-stream changes from acceleration to slowing and further to stasis and thrombosis, according to the increasing violence or strength of the infection. If in a case of already advanced inflammation I cause an increase of the inflammation, just so much earlier do I bring about the end changes in the blood-stream, viz., stasis and

thrombosis which through impairment of nutrition cause injury to the tissues. One does not even need to go into the finer points of inflammatory changes in order to reach a conclusion not in accord with the principles of Bier's treatment, at any rate in severe infections. The mere course of the inflammation in its entirety if closely observed also teaches the same.

We may daily notice that in light infections the body may completely recover without destruction of tissue; also, on the other hand, that in severe cases the process goes on to necrosis and pus formation. When I, in a light case, intentionally increase the inflammation and cause it to assume the character of a severe infection, the more often will it go on to necrosis and pus formation. From these considerations one sees that it indeed may be used in light cases. Through increase of inflammation one may expect to cause an increase of resistance. Also that this endeavor is limited by the intensity and especially the extent of the process, and that in severe cases it can result only in harm.

Lexer (3) was the first to point out the danger of increased destruction of tissue through intensification of the inflammation by Bier's method, comparing the result to the action of a cataplasm. It is possible theoretically to arrive at the same conclusions from the general picture of the process as from the single known phenomena of the inflammatory process.

When the blood stream is slowed, we must have an increased tendency to stasis and thrombosis and, therefore, disturbances of nutrition. With an increased emigration of leucocytes and an increase in their destruction, we must have an increase also in the proteolytic ferment and, therefore, an increased liquefaction of tissues, etc. One may easily observe the similarity to the action of a cataplasm in all cases of severe infections treated by passive hyperæmia in which there was either no incision or an insufficient one. In cases where pus is already present, showing the liquifying character of the process, or in cases where we have to deal with a severe infection surely leading to phlegmon formation, one will not fail to see the increasing destruction with pus and necrosis as a result. This was already shown, for instance, by the histories from the clinic at Königsberg published by me (2), but any one can demonstrate that in any progressive process leading to abscess, for instance, in one of the well-known severe fascia phlegmons of the extremities, by making too small incisions and then treating them by passive hyperæmia. Frangenheim (5) has lately published experimental proof of this increased tissue liquefaction in treatment by the cupping glass.

If the simple logical consideration of the principle, viz., to combat pus infection by an increase of inflammation, has already led to a *narrowing of the scope of its applicability*, we must also be impressed, upon further consideration, by *two other conditions of lessened applicability*.

The body is not always in condition to produce the increase of inflammation above that which it already has. There are patients in whom it is impossible, with the means at our command, to increase either the inflammation or the reaction at all. Joseph (6) first noticed this in Bier's clinic, and emphatically pointed it out. In such cases, one must naturally turn to some other method of treatment. In the second place, the consideration forced upon us is, that by the imitation of the natural course of the disease, we must take not only the present injuries but also the possible dangers into the bargain.

First of all, it is beyond our power, yes, even beyond our judgment, to say if a pus infection when left to itself will spread from one tissue to the neighboring one, viz., from subcutaneous tissue to periosteum, joint capsule, or tendon sheaths. Would not the danger in a severe infection be increased by an increase of liquefaction of tissue?

Secondly, there exist for a long time during the application of the "natural" healing methods (F) all the dangers of a spreading by the way of the blood or lymph stream until such a time when the body in general overcomes the disease; but this time or point we are not able to bring on arbitrarily, and therefore the principles of the treatment by passive hyperæmia are at the outset connected with uncertainty of result.

Non-applicability in severe cases and the *uncertainty of the results* are the disadvan-

tages which the very principle of Bier's treatment from the outset carries in itself, while the contrary is true of the old treatment. Of course, one cannot bring the antiphlogistic treatment into comparison as the ruling principle, as Bier does in "Hyperämie als Heilmittel;" rather the removal of the cause of the trouble, together with their toxins from the body by means of incisions and drainage. The modern physician has, since the importance of immunity has become known, discarded the use of the ice bag and other antiphlogistics in the treatment of acute purulent infections. The modern physician is dependent upon bacteriology. His need for causality in therapeutics is directed, not to the *symptoms* of inflammation, but to the *cause* of the disease, viz., the bacteria and their toxins; these will he combat, and according to the principles underlying his treatment, he makes an incision in order that the cause of the disease, bacteria as well as their toxins, may by tampons and drainage, be brought to the surface and eliminated.

The principle that that which is outside the body can do no harm, seems to me to be far better than the principle underlying the treatment of Bier, who takes the presence of bacteria in the body as an unavoidable condition and only cares to strengthen the body as much as possible, in order that it may overcome the cause of the disease. The poor body! Why should it bear the burden of elimination alone? Is it not better to come to its help with a scalpel and relieve it of all danger possible? It has all it can do to cope with that part of the disease products which we are unable to remove. The ideal of surgical therapy is to know the cause, act accordingly, and not wait to see if the body will be so kind as to react to the strengthening measures of internal medicine.

The ground principles of the Bier treatment correspond completely to the conditions found in internal medicine. The body must bear the burden alone and must put forth all its resistance, it must win the fight alone. Why all this, when we can relieve it? The necessity which every physician more or less feels, viz., to direct his measures against the causes of disease, opposes completely the principles of Bier's treatment which combat the bacteria only indirectly. All inquiry points to the fact that the bactericidal strength of the congestion produced by Bier's method may not be of so much importance.

Laqueur (8) thought he found in the blood stream of a passive hyperæmic limb an increase of bacterial antibodies. His experiments are not free from criticism (9). I believe it less probable that on account of rapid compensation by the fast streaming of the blood, even of blood in a congested limb, a local heaping up of the antibodies is to be seen. Other authors have pointed out, or missed an increased amount of antibacterial matter in the œdema fluid of a passive hyperæmic area (9). The results of laboratory experiments fluctuate so, that much cannot be said to uphold the theory.

Animal experiments also give no special information as to whether the passive hyperæmia in itself is bactericidal in its action or not. Noetzel's (10) experiments point in this direction. Heyde and Baumgarten's (11) experiments show that that power may at any rate be only slight. I have myself clinically pursued the question of increase in the bactericidal power and have arrived at the conclusion that it is uncertain and can be used only in a limited way.

(*a*) I have in 50 cases repeatedly examined the secretion of an incised focus of inflammation during the healing, bacteriologically, and in no case was I able to demonstrate by enumeration a marked decrease in the organisms.

(*b*) I also examined foci not in communication with the air which had been treated by passive hyperæmia after many days, in single cases after many weeks — joints, for instance — and found many actively growing bacteria.

(*c*) One sees not so seldom during the treatment by passive hyperæmia, metastases, lymphangitis, lymphatic infiltration and phlegmons, lymphadenitis etc., in the congested area.

Since, at the beginning of the treatment, nothing was seen clinically of these metastases, one must reason that either the bacteria in small numbers were already at the sites of the metastases and developed in spite of the hyperæmia, calling forth inflammatory processes, or that single bacteria slipped out of the inflammation focus and subsequently, in spite of the hyperæmia, settled there and also, in spite of the treatment, developed.

(*d*) When one dispenses too early with the treatment, that is, as soon as the clinical signs of the inflammation subside, there develops a light recurrence (Stich, Croce, Haasler, Tuffier, Wrede).

(*e*) Secondary infections develop in the incised foci; pyocaneous bacilli, bacteria of putrefaction, staphylococci and streptococci settle there and may develop their specific infections at that point, for instance the occurrence of erysipelas during the treatment (v. Brunn, Bier, Wrede).

It must occur to one that in the beginning only a few bacteria fall upon the wound. Consequently, the bactericidal power of the passive hyperæmia, even against this small amount of infection, is denied.

We cannot demonstrate a convincing decrease of virulence after the passive hyperæmia. Exact proof (for instance, by animal experiment) is not possible, because we have no procedure at present by which we can measure the virulence of pus cocci. But just the occurrence of frequent lymphatic metastases within the area of passive hyperæmia, as well as the immediate recurrence following the too early removal of the bandage used in the treatment, speak against the bactericidal action of the treatment as well as against the decrease of virulence.

After all this, I am prone to believe that the old treatment is to be preferred to the treatment of Bier, because *the old method* is more certain, and above all, remains applicable to the severe cases. Every physician knows from his own experience that he may be deceived at the beginning in regard to the severity of the pus infections.

In order to carry out the principles of his treatment in practice, Bier employs a slightly constricting bandage and the cupping glass. He believes that the inflammation is followed by enlargement and slowing of the blood-stream, and will, therefore, call forth a congestive hyperæmia.

I have already at length explained my *views derogatory to the passive hyperæmia in the general picture of inflammation as well as against the usual comprehension* of the circulatory occurrences in the *Bier treatment*(12).

I am reminded here that an arm upon which a bandage is rightly applied is very red and hot, not blue and cold as it must be in real passive hyperæmia. I shall not further elaborate upon such theoretical objections because they are of less importance on account of the fact that actually an increase of inflammation takes place, be it by means of the constricting band or be it by means of the cupping glass.

It is true, this increase of inflammation does not occur *without the alterations of the usual picture of the inflammatory process.* Most striking is the marked *œdema* which at the same time is undoubtedly one of the most important qualifications of the Bier treatment. It is, according to Ritter (13), the unquestioned and almost constant factor to which is ascribed the relief of pain, because it in a short time corrects the isotonic difference between the products of inflammation and the tissues in which they lie. It is that which copiously dilutes the inflammatory toxins, rendering them in part innocuous, as the poisonous effect of a substance depends in no small way upon its concentration (proven by experiment). It is also that which has an antitoxic and antibacterial effect by increasing the volume of effective fluids, not by concentrating the antibacterial powers (Nötzel, 10). However, it has its dark side; if the œdema is too intense, the smaller blood-vessels are pressed upon, thereby hindering all the more the already altered circulation (Joseph) (14). Further, the soluble inflammatory products are dispersed by it from the focus of inflammation all over the area of passive hyperæmia (Lexer). By this means the bacterial products reach parts which they otherwise would not, and bring about the danger that also they may continue their work of destruction. A proof of this is the not seldom occurring redness characteristic of the passive hyperæmic treatment which resembles erysipelas but is differentiated from it by the absence of the raised border and disturbance of the patient's general condition. Moreover, there is a great difference whether the œdema has occurred in an area covered by intact skin or whether it has been incised (Lexer), the hyperæmia, the escape of formed as well as unformed elements of the blood from the vessels, causes an increased tension, but as soon as an incision is made, the œdema as well as the tension is reduced. The œdema will flow off, following the static laws of pressure, and washes out the tissue; bacteria and their toxins as well as cells and cell detritus are washed out of the focus and escape upon the surface. This takes the place, consequently, of drainage by means of tampons and tubes which we are in the habit of using.

Therefore the cupping glass is very applicable to the open and quiescent foci of infection, for instance, a localized abscess. Such foci heal naturally in this manner, viz., cleansing themselves by means of secretion from the deepest parts in order that scar tissue may form. The cupping hastens and increases this course by forming an œdema and drawing it out.

It is, however, a crude imitation of the natural process, in that the application of great force suddenly and interruptedly, is different from the continuous and slow flow of the natural process. The loosening of thrombi, the rup-

ture of blood-vessels, the rekindling of inflammation, when the efforts of the tissue to overcome the bacteria had been already successful, may do harm.

When, on the other hand, the œdema cannot by means of an incision find its way to the surface, it must be resorbed, and that occurs very slowly during the passive hyperæmia, it being not completely stopped. On the other hand, during the "pause" in the Bier treatment it is quickly absorbed, especially when, as Bier directs, the limb is elevated. *By this procedure, the body is suddenly flooded by the œdema fluid which carries with it the soluble substances of the inflammatory process.* A part of the toxin was probably, through the œdema, rendered innocuous; a part also probably had already entered into combination with the tissues, thereby becoming inert. How much, however, in this manner is rendered harmless we are not able to judge. It is also not under our influence and depends entirely upon the virulence of the infectious process. If a large amount of toxin is formed, then surely the œdema contains a large amount in uncombined form.

The œdema of passive hyperæmia represents a solution of toxins, as Joseph has rightly observed.

These poisons are now suddenly thrown into the general circulation and affect the whole body; whether or not they produce the phenomena of disease or whether they may be entirely destroyed and excreted, depends upon the amount of the toxins. It is also to be noticed that we are in no way able to influence this, and that we, by the release of the constricting bandage, precipitate a poison generally throughout the body, also that we have no way of judging the strength of that poison. These are not merely theoretical conceptions, for after the removal of the bandage, in cases of severe infection, in proof of the resorption of toxins a quick rise of temperature, many times combined with chills and disturbance of general conditions, follows. It seems that Bier did not give special attention to this, as he reports a case of a little girl who for 14 days had signs of resorption with a daily rise of temperature (40 degrees C.). Bier's pupil, Joseph, who held this case up as an example, named this rise of temperature "the fever of passive hyperæmia."

The name is unnecessary and may lead to errors, as according to the temperature curve one can see that we have to deal simply with a fever due to resorption. I cannot agree with the view that the resorption of toxins is an indifferent matter, but I would rather seek to avoid it. Certainly, it may be possible for an otherwise healthy and strong man to take care of a large amount of toxin and seem to suffer no ill effects from the high temperature, etc., but where does the nephritis, cardiac weakness, and all of those conditions following in the course of infections come from, unless it be from the resorption of toxins from the foci of infections? *Thus, not only does the principle but also the application of the Bier method carry with it the dangers of resorption of toxins from inflammation.* To be sure, Bier lessens the danger in practice, in that he, lately, more than before, makes use of the incision. He also, in phlegmons of the tendon sheaths for instance, incises as widely as one would if he were not going to use the passive hyperæmia. But Bier mistakes and underrates the value and importance of the incision in his treatment. He regards the incision as a side issue and lays no real weight upon it. However, the well-known "puncture" and "small incision" are given less attention by Bier than by his followers who consider them as valuable adjuncts to the method. That, however, is not true; in spite of the treatment by passive hyperæmia, one dare not make smaller incisions than are necessary without the hyperæmia. They must be large enough to afford all protection from resorption possible to the body, even if the method of Bier is to be used, if one would not uselessly and petulantly endanger the body.

Relative to the removal of the toxins after an incision has been made, the bandage and the cupping glass are of no more advantage than a rightly placed capillary drain (gauze) or a tubular one. Upon the judgment of the *incision,* as compared with the passive hyperæmia, hinges the contention between the followers of Bier and his critics. Beside these, all other such points, as, for instance, expression of pus, early movement, etc., are placed in the background. At any rate, much depends upon which preliminary conditions one judges the

questions. Whoever has been in the habit of treating felons with moist dressings and poultices until the pus is almost ready to break through of its own accord will, without doubt, have better results if he incises according to Bier, as soon as the presence of pus is determined.

Whoever has been in the habit of recklessly opening up the tendon sheaths to the fullest extent and used tamponade for many days, when a phlegmon was present, will be pleased with the results if he makes many small incisions and does away with the energetic tamponade, with a view of saving the tendon and retaining motion. But that is no ground to be inspired with praise for the treatment by passive hyperæmia. The better results are already explained by proper incisions, and are not due to the hindrance of the blood-stream. On the contrary, whoever will take the trouble to observe severe cases treated by passive hyperæmia without incision, will very soon learn the value of incisions, and if he will then subtract the influence of the incision from Bier's hyperæmia procedure, it will probably befall him as it has the critics of the method, he will be sceptical of passive hyperæmia. It all depends upon the glasses through which one observes.

It is hardly an accident that the ideas against the method should go out from the school of v. Bergmann, who always had the greatest interest in wound infections, and who was always so anxious to establish a scientific treatment of them. He had always held to the principle that inflammatory products must be conducted to the surface and the tissues protected as much as possible. Suitably large incisions, cautious tamponade and drainage, rest, and, whenever possible, elevation of the affected limb, were his principal means of treatment. These principles were also followed out in the surgical clinic at the University of Königsberg until the general enthusiasm over Bier's method compelled to examine it. We could not join the others' enthusiasm, and have returned to the old methods. It was not possible for us to convince ourselves that the new method had advantages over the old. On the other hand, we found it, through the necessity of continual observance by the physician, quite unpleasant where a large number of patients were being treated, and we are convinced that the old method is more trustworthy.

For severe cases, we hold the passive hyperæmic treatment as improper, for medium severe cases we do not see why increased pus formation and liquefaction of tissue, why local extension and secondary infection of the lymphatics and lymph glands, why a continuation of the fever and the like, occasionally should be taken into the bargain.

After our old treatment we expected on the following day a marked improvement.

After the new treatment one remains, many times, several days in uncertainty, whether or not a worse condition is beginning.

On that account we cannot give preference to the new over the old and approved method, even if it occasionally in lighter cases may be used with benefit.

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ACUTE POST-OPERATIVE DILATATION OF THE STOMACH[1]

Report of a Severe Type with Recovery

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INCREASED study of the condition of acute dilatation of the stomach has shown that the mortality of this serious and severe lesion has been in the past between 60 and 80 per cent. A lowering of these figures, however, in future may be confidently expected through the earlier recognition of the state of affairs and the immediate application of a rational therapy. An indelible impression is left on the mind of anyone who has once seen this alarming and terrifying condition and such a one is not likely to forget the lesson thus dearly taught; for it must be confessed that one's first case of this kind is very likely to pass undiagnosed until too late to institute availing treatment. However disputed the etiology and actual pathology, it is now fairly well understood what measures are to be taken with the greatest hope of attaining success in treatment.

The following case is typical of the lesion in question: A married woman, of thirty-five years of age, came to see me on February 22, 1908, giving the following history. For the past year — much worse for the last six months — she has had dull, aching pains under the right costal arch, radiating, with less intensity, down the right side of the abdomen and into the pelvis, accompanied with backaches. Never jaundiced, nor had she ever had an attack of frank colic. Micturition and menstruation always normal and unchanged. Stomach trouble for some time so that she is afraid to eat because of pain and distress afterwards. Never any nausea or vomiting. Very constipated. Has lately lost twenty-three pounds in weight. Has had to give up all kinds of physical work because of the increase in the subcostal pain and backache which it brings on. Is weak and dispirited.

Examination shows a spare and anxious-looking woman. The heart and lungs are normal. Some general enteroptosis but neither kidney is palpable. Liver edge not felt nor are any abdominal masses to be appreciated. In the right mammary line, there is some tenderness just beneath the ribs. There is also tenderness to the right of the navel. The appendix can be felt in the usual position, rolling under the finger and tender. Vaginal examination shows the uterus to be firmly fixed in a low position and any attempt to move it causes considerable pain. On the posterior surface of the uterus, in the right side of the pelvis, there is felt a hard, nodular mass, the size of an orange.

Diagnosis, general enteroptosis of mild degree, uterine fibroids, and chronic appendicitis.

Operation in the Presbyterian Hospital on February 26, 1908. Nitrous oxide and smooth ether anæsthesia. Kammerer incision through the right rectus below the navel. Hand inserted palpitated the gall-bladder, which was found to be normal, non-adherent, and containing no stones. No adhesions about the stomach could be detected. Trendelenburg position. There was a hard, nodular, fibrous mass, about the size of a grape-fruit, attached to the posterior surface of the fundus, a little to the right of its middle, with a pedicle about the size of one's thumb. It was firmly wedged in the pelvis, accounting for the previous obstinate constipation. The pedicle was cut out of the uterine tissue and the defect closed with catgut sutures. Three smaller fibroids were removed from beneath the peritoneum in various regions of the uterus and the gaps sutured. A cyst, the size of a hickory nut, was excised from the right ovary, and the edges of the defect were brought together with plain catgut. The appendix was found adherent to the end of the pelvis by a firm band and its tip was clubbed and bent. It bound the cæcum tightly to the pelvic brim so that its mobility was seriously compromised, which may account for some of her digestive symptoms and right-sided pain. The appendix was removed between two plain catgut sutures, its stump cauterized and buried beneath a purse-string suture of plain catgut. The uterus was suspended to the anterior abdominal wall by two chromic catgut sutures. Closure of the abdomen by layers without drainage. Length of the operation, forty minutes. The postoperative condition of the patient was excellent, requiring no stimulation.

After course. On the third day, the patient complained of severe abdominal pains, generally distributed, for which she was given turpentine stupes and magnesium sulphate by mouth, together with a high, oil, turpentine enema, followed in an hour by a low, soap suds enema, but without any gaseous or fæcal result. Vomited frequently during that night with great eructations of gas. On the morning of the fourth day, she was much distended, generally distributed over the abdomen, but there was no tenderness, rigidity nor masses to be felt, nor was there visible peristalsis. The stethescope applied over various regions of the abdomen detected very few peristaltic sounds. Contrary to what

[1]Read at a meeting of the Section on Medicine, New York Academy of Medicine, May 19, 1908.

has been so frequently noted in acute dilatation of the stomach, at this time there was no flattening of the lower part of the abdomen with a bulging epigastrium. It is very likely that this early stage had occurred during the preceding night and had passed unobserved by the house staff. The pulse was 100 and the temperature 100.5°. She was vomiting frequently small quantities of straw-colored, somewhat foul fluid. On the morning of the fourth day, the patient was given catharsis, enemata, and lavages, with the relief of the vomiting for a time and with a small fæcal fluid defæcation as a result. Two hypodermoclyses were given during the day of salt solution to assuage her great thirst. At nine P. M. of the fourth day, one ounce of oleum ricini was left in the stomach, being passed through the tube after a lavage. At the same time the foot of the bed was elevated four feet. On the morning of the fifth day her condition was alarming and a fatal termination was expected and prognosticated. The temperature had risen to 102° and the pulse was 150 and weak and small. The prostration was extreme and she had a most anxious and appealing expression of face. The abdomen was enormously and uniformly distended, but there was no tenderness anywhere nor could any muscular rigidity be made out. Lavage was given every four hours and very large quantities of bile-stained, foul, though not fæcaloid material was removed. Twenty minutes at least were required to wash the stomach clean. These lavages controlled the vomiting, but continuous nausea was present. All fluids by mouth were forbidden and salt solution in large quantities was administered by rectum and under the skin. Physostigmine salicylate, gr. $\frac{1}{40}$ every four hours, was given hypodermatically, as intestinal peristalsis seemed at a standstill. In addition to the previously instituted high elevation of the foot of the bed, the patient was turned over on her abdomen and made to lie on her sides. The knee-chest position was out of the question because of the great weakness. Gentle massage was also given to the abdomen, the strokes being directed from below upwards. The lavages were exceedingly grateful to the patient, so much so that she asked to have them given more frequently. It was a difficult question to determine whether a high intestinal obstruction was not present and at one time a laparotomy was seriously considered. It was finally decided that the condition present was probably an acute dilatation of the stomach. In any case, a laparotomy was thought to be an extremely hazardous and desperate procedure in view of the patient's prostrated condition. On the morning of the sixth day she seemed better in her general condition, although the temperature had risen to 103° but her pulse had not increased in rapidity, being about 140, nor materially weakened. She passed a large, fluid, fæeal dejection with much gas following a high, oil, turpentine, asafœtida and magnesium sulphate enema. The distension became markedly less. This dejection seemed to be the beginning of her improvement which then rapidly and steadily progressed, although large but decreasing quantities of fluid were obtained at intervals by the tube from her stomach. When the lavage was omitted, she continued to vomit for several days longer, so that frequent resort to them was still necessary. A diarrhœa then set in which continued for a number of days. The wound healed solidly by primary union and there was no further setback in her convalescence. During the remaining time of her stay in the hospital, daily lavage was given in order to help the stomach to regain its tone and to overcome any tendency to stagnation of its contents. Prior to her leaving the hospital, an enteroptosis belt was applied and worn with the greatest comfort.

Three months after the operation, the patient's condition was all that could be desired. She was quite strong, performing all of her ordinary work with comfort. She was eating with relish almost everything and suffered only occasional discomfort. She had gained fifteen pounds in weight.

On May 25, 1908, three months after the operation, she was very kindly examined for me by Dr. Herbert S. Carter, who reports as follows:

Stomach: The greater curvature is 2½ inches above navel by inflation and water test. Splashing absent, except in forced palpation, then faint. Test meal, a roll and water ingested shows after one hour small residue, only a few c.c. This in itself is evidence of excellent muscle power and no myasthenia.

Chemical examination shows a considerable degree of achylia. Thus: no mucous; no free hcl; total acidity only 16; starch digestion good; biuret reaction faint; lab-ferment active.

Microscopic examination—starch granules.

The mechanism of acute dilatation of the stomach is a moot question as yet satisfactorily unsolved. It was thought originally that the primary cause was the obstruction of the duodenum by the pressure of the root of the mesentery (principally the mesenteric vessels), which was drawn taut and dragged upon by the weight of the small intestines, which had become prolapsed into the pelvis, for some more or less unknown reason. But this theory has been attacked and disputed by numerous writers, as a result of further autopsy studies; for Laffer, who has written a most brilliant monograph on this subject (Annals of Surgery, March and April, 1908), showed that in only 27 of the 120 autopsies on patients who had died of this complaint, was compression by the root of the mesentery present, while in only 21 instances were the small intestines prolapsed into the true pelvis. The stomach, however, was *always* found dilated, and this is the most striking fact which must be taken into account in considering this condition. It very often occupies the entire abdomen from the costal arch to the symphysis. The question is whether this dilatation of the stomach is the

primary lesion or whether it is simply a secondary result of the stasis, dependent upon the compression of the duodenum by the mesentery. With respect to this, Laffer says (page 413): "I believe that the clinical, pathological, and experimental data are strongly in favor of acute dilatation of the stomach as being primarily an innervation disturbance affecting either the centers in the brain or cord or the nerve paths connecting the stomach with these centers. In support of this explanation, I am able to name not less than twenty-seven writers on this subject, including those who have given the matter the most consideration and who have done the best experimental work." And again he says: "Whatever the etiology, the primary trouble is not the dilatation, but the motor insufficiency, which leads to the dilatation from the accumulation of gas, due to fermentation and the retention of the ingested food and drink, together with the over-secretion." Authorities differ as to which is primary, the stomach dilatation or the duodenal compression. Albrecht, Bäumler, Binswanger, Schnitzler, regard the duodenal compression as the causal condition while Braun and Seidel, Garrè, Herff, Kansch, Krehl, Riedel, and Stieda lay the chief stress on the stomach dilatation.

Thoma reports (Deutsche med. Wochenschr., March 19, 1908) a postoperative case in which there were two attacks of this trouble during convalescence. He argues strongly for the view that the dilatation of the stomach is the primary condition, being due to an acute, motor insufficiency of a functional nature and that the compression of the duodenum is a secondary result, being caused by the crowding of the small intestines downwards by the enormous stomach.

It must not be forgotten that the third portion of the duodenum is bound very firmly to the spinal column by the muscle of Tritz. As a a result of this anatomical arrangement, it can be readily conceived how it might easily happen for a kink to take place in this portion of the duodenum when the stomach and more proximately movable part of the duodenum become so largely dilated.

Diagnosis. This is usually easily made if one in any given case has in mind the possibility of acute gastric dilatation. The symptoms are in general about as follows: In the post-operative cases, occasionally immediately after the narcosis, but more usually some days later, there sets in, as the most prominent symptom, very profuse uncontrollable vomiting, of a non-projectile type, consisting of sour-smelling fluid, which may contaln yellowish and blackish particles, in amount greater than that ingested. It contains bile, sarcinæ, yeast, and at times pancreatic fluid. Blood in the vomitus is a rare occurrence, nor is it ever fæcaloid. The patient complains of pressure and tension in the epigastrium, which, in the beginning stage, becomes distended locally, the remaining portions of the abdomen remaining flat and soft. The distended upper abdomen is not tender to pressure, nor is there true muscular rigidity, that which is present being due to the pressing forward of the muscles by the distended stomach. These latter signs rule out an inflammatory peritonitis. The localized epigastric distension, with the very marked splashing sounds which may be elicited by palpation, render the diagnosis very probable. If, however, with the stomach tube large quantities of fluid are obtained, associated with diminution in the epigastric distension, then the diagnosis of gastric dilatation is certain. Soon the distension extends over the whole abdomen, which becomes enormously ballooned up. It is not easy in any given case to determine whether the stomach dilatation has not, in addition, led to a duodenal occlusion. If, however, pancreatic fluid is found in the contents from the stomach, if the stools become acholic, and there is a strong indicanuria, and if the stomach tube affords no relief, then one may reasonably conclude that a duodenal obstruction has become superadded to the stomach dilatation. Intestinal peristalsis becomes gradually paralyzed. Flatus and stools in the beginning are passed, but these soon cease, and pesistaltic sounds over the intestines become faint and few. The pulse progressively increases in rapidity, and its volume markedly diminishes, to become thready later on. The tongue and lips are very dry and parched and thirst is unquenchable. The facies is pronouncedly hippocratic, and prostration becomes rapidly extreme, so that a condition of shock comes on, to be followed

by collapse, if no relief is afforded. The temperature is apt to be normal or subnormal, although this is not absolute, as the case cited above indicates.

Treatment. With the application of early and appropriate medical treatment, I believe that operative measures will very rarely be necessary in the acute condition, and the mortality will be fairly small. If the dilatation of the stomach be the primary lesion, then the early and frequent use (every two or three hours) of the stomach tube, washing the stomach clean each time, would prevent the development of the second stage, namely, either the kinking of the duodenum or the compression of the duodenum by the dragging upon it of the root of the mesentery, caused by the forcing of the intestines into the pelvis by the large stomach. If, however, the obstruction of the duodenum be the primary lesion, as some contend, then the postural treatment, ventral and lateral positions with high elevations of the foot of the bed, would be imperative at the outset. Since we can only recognize the disease by the symptoms referable to the stomach alone, it is obvious that the two combined measures, lavages and postural changes, should be instituted at once, in the beginning, to achieve the best results. For it has occurred that several cases have not gotten well with lavages alone until the posture treatment was begun. Dilatation of the stomach itself is a severe disease but it is made much worse by the duodenal compression, thus forming a vicious circle. That the duodenal compression has not always been found at autopsy is perhaps due to the fact that an early instituted therapy has prevented the development of the compression stage. Posture treatment should not be carried out until after the stomach has been emptied by the tube, for otherwise the heavy stomach, weighted with fluid, might seriously embarrass the action of the heart and lungs by pressure on the diaphragm.

It is needless to say that when such a condition is suspected to be developing, absolute abstention from the ingestion of all food and drink into the stomach is imperative. Large quantities of salt solution should be gotten into the system, administered under the skin or by rectum. Combined with the postural treatment, gentle abdominal massage, crowding the abdominal contents upwards away from the pelvis, will be found advisable, this to be succeeded by the binding of a pad firmly on the lower part of the abdomen. Turpentine stupes, intermittently applied to the abdomen, physostigmine hypodermatically, high enemeta. will be found advantageous in stimulating the sluggish peristalsis. All possible means to combat the shock should be vigorously employed, such as ergot mxx hypodermically every four hours, and adrenalin, one drachm to the pint of salt solution, by rectum or under the skin, every two or three hours.

Various operative procedures have been advocated in case the above purely medical measures fail of relief, i.e., when the dilatation of the stomach persists and the accumulated fluid fails to pass. Of these gastroenterostomy is the favorite one mentioned. Laffer says with respect to this: "The operative treatment is falsely based on the belief that most of the cases are due to a compression of the duodenum by the root of the mesentery, or on the assumption that gastroenterostomy is a drainage operation. The autopsies have shown that the compression theory is not true in the great majority of the cases, and, against the drainage idea, we have the experiments of Kelling and Cannon and Blake, which show that a gastroenterostomy is of little or no use as a drainage measure."

Many gastrotomies have been performed, usually because the dilated stomach has been taken for a cyst, and all these cases have died (Laffer). The patients are usually in such a seriously poor physical condition that only the quickest procedures are possible. On theoretical grounds, it seems to me that a high jejunostomy best meets the exigencies of these cases, for it can be very speedily performed under cocaine anæsthesia if necessary, while, in addition, the duodenum may be drained by the passage of a tube from the opening in the jejunum through the duodenum even into the stomach itself, if thought best. A tube may also be passed distally down the jejunum for the introduction of cathartics, stimulants, salt solution, and nourishment as required. Meantime the stomach itself must be kept free from its increased secretion by frequent lavage.

Acute dilatation of the stomach and arteriomesenteric ileus are diseases which develop not only in the domain of surgery but which are equally of interest to the physician. For in the 217 cases reported from the literature by Laffer only 38 per cent followed operations. The following is a partial list of the concomitant diseases and etiological factors found in these 217 cases:

Ninety-seven followed operations (69 per cent of these were laparotomies); 17 followed trauma ; 40 occurred during some serious desease (i.e.: pneumonia, 6; appendicitis, 4; cancer of the œsophagus, 3; abscess of the jaw, 3; tuberculosis, 4; brain diseases, 2; etc.); 11 spinal deformity; 1 aneurism pressing on the pylorus; 6 peritonitis; 5 in the convalescence from typhoid; 2 in the convalescence from acute rheumatism; 1 in the convalescence from scarlet fever; 20 errors in diet; 3 drugs; 3 emotional causes; 1 chronically dilated stomach; 2 complicated confinements.

It is only necessary to glance through this list to realize how impossible it is in the present state of our knowledge of the subject to say in what given case acute dilatation of the stomach is likely to occur. All we can state is that a severe depression of the nervous system somehow seems to antedate its development.

The acute condition resulting from dilatation of the stomach and acute gastromesenteric ileus have engaged the attention of the great majority of the writers and the possibility of the occurrence of chronic symptoms depending on chronic compression of the duodenum by the root of the mesentery has been mentioned by only two writers, so far as I know. The first was Bloodgood (Annals of Surgery, November 19, 1907, pages 743 and 761), who operated upon a patient in whom he found what he considered to be an example of chronic gastroduodenal dilatation or gastromesenteric ileus. For a year prior to operation, the patient had had five acute attacks, each lasting about three days and relieved by calomel. Between the attacks she suffered from indigestion and belching. At the operation, the stomach was found moderately dilated and the duodenum was a dilated U-shaped organ, extending high up under the liver and surrounding the pancreas. The duodenum and pancreas were unusually movable, except the third portion of the duodenum which was less so. The contrast between the duodenum and jejunum as to caliber was unusual.

In referring to this case, Bloodgood says: "Further experience may demonstrate that this is the common pathological condition of many cases of gastric neuroses which have not been relieved by posterior gastroenterostomy and which may be relieved by an anastomosis between the duodenum and jejunum."

The second writer on chronic gastromesenteric ileus is Codman who considers the subject extensively and theoretically in an elaborate article in the Boston Medical and Surgical Journal of April 16, 1908, page 503. His analysis of the subject is very suggestive and opens up a new field of thought as to the etiology of some obscure gastric difficulties. His contentions are as follows:

1. That in the human body, the transverse portion of the duodenum (because of the erect bodily posture in man) is more or less compressed by the root of the mesentery.

2. That slight anatomical deviations from the normal, or certain pathological conditions, may increase this pressure to a varying extent up to the point of complete occlusion of the gut.

3. That when this pressure reaches a degree great enough to give more resistance to the muscular efforts of the duodenum than the closed pylorus, the condition becomes of pathological importance.

4. That thus anatomically the duodenal secretions are brought in contact with mucous membranes unfitted physiologically to withstand their corrosive action.

5. That the obstruction favors stasis in the duodenum and thus bacterial invasion of the tissues.

6. That if the above propositions can be proved, they will materially alter the present conceptions of the etiology and treatment of the variety of pathological conditions, i. e., hyperchlorhydria, nervous dyspepsia, gastric and duodenal ulcers, pancreatitis, cholelithiasis, persistent vomiting after laparotomy and pregnancy, and excessive fluid drainage from wounds in common duct and duodenum.

DIFFUSE PERITONITIS IN WOMEN[1]

With Report of Fifty Cases

By ELLICE McDONALD, M. D., New York City

PERITONITIS is usually the result of some pathological lesion of which it is a grave complication. These pathological lesions may rarely be accompanied by peritoneal involvement and may be in themselves, when uncomplicated, comparatively benign diseases, while others may be grave and even fatal. The gravity of the peritoneal lesion, however, causes treatment to be directed towards it, and it may be considered almost a clinical entity to be studied as such.

While the cause of peritonitis is in every case an infecting microorganism, the gross causes of origin and mode of infection of the organisms have important bearing on the prognosis and treatment of the disease. Thus, a peritoneal infection from the Fallopian tubes has a different course from an infection with a similar organism from the small bowel. The gross causes of peritonitis are many and the frequency and severity of the peritonitis associated with them are in the main different.

It is important, therefore, not only to study the various bacteriological causes of infection, but also the various modes of transmission of these bacteria. A more accurate knowledge of the course and severity of the different forms of peritonitis will aid the plan of the treatment, which is at present vague and unsettled.

In the study of peritonitis, distinction should be made between the two forms, localized and diffuse. Localized peritonitis is that in which the infectious material is well surrounded by limiting adhesions and other structures as intestines, so that all pus is confined. Diffuse peritonitis, on the other hand, may not necessarily be spread over a wide area; but the pus is not limited but free in the peritoneal cavity. The old term "general peritonitis" is not absolutely exact, although in common use; and in this series the term diffuse peritonitis is taken to mean peritoneal infection with pus in both flanks and the pelves.

Recent contributions upon this subject have helped to extend our knowledge and improve the treatment of the condition. Clairmont and Ranzi (1) in a study of 41 cases of diffuse peritonitis have discussed the etiology, symptomatology, and treatment. There were 25 cases of diffuse purulent infection of the peritoneum after appendicitis. Fifteen cases ended fatally. Those infections following perforation of the appendix were less dangerous than those following rupture of perityphlitic abscess, and the infections following gangrene were the most serious. After the perforation of the stomach there were 6 cases with 3 deaths. Two patients died following infection from duodenal ulcer. There were 2 cases from gall-bladder disease. One case followed rupture of a pelvic abscess and one followed an incarcerated hernia. Four infections were caused by traumatic rupture of the intestines.

Dudgeon and Sargent (2) in a study of 258 cases of peritoneal lesions found diffuse peritonitis 56 times. In these cases, the peritonitis followed infection from the bowel 45 times, being distributed as follows: After strangulated hernia 4, after intestinal obstruction 3, after perforated gastric ulcer 9, after perforated typhoid ulcer 1, and after appendicitis 28. There were 40 cases of appendicitis with localized abscesses amongst the series of 258 cases of peritoneal involvement. Four cases of diffuse peritonitis were due to pelvic causes, 1 to rupture of a pyosalpinx, 2 to infected ovarian cysts, and 1 to pyometra from pneumococcus infection. Accidental infection, as postoperative extension of an infectious process, accounted for 6 cases.

These authors state that, of 258 cases of peritoneal lesions, the staphylococcus albus was isolated 108 times (3). "They claim to have established the pre-eminence of the colon bacillus as a cause of peritonitis and to have disproved the favorite theory that the lesions

[1] Read before the New York State Medical Society, January 28, 1908.

INFECTIONS FROM BOWEL

Case.	Local Lesions.	Character of Peritonitis.	Complications.	Organisms.
1.	Carcinoma of Sigmoid.	Acute purulent.	Intestinal obstruction.	Streptococcus.
2.	do.	Acute fibro-purulent.	do.	—
3.	Carcinoma of small intest.	Acute purulent.	Perforation. Acute bronchitis.	Streptococcus.
4.	Carcinoma of Intestine	Acute fibro-purulent.	Perforation.	—
5.	Carcinoma.	Acute fibro-purulent.	Perforation.	Bacillus Coli.
6.	Cholelithiasis Cholecystitis.	Acute fibrino-purulent.	Perforation of gall-bladder.	do.
7.	Chronic Cholecystitis	Fibrino-purulent.	Gangrenous gall-bladder.	do.
8.	Cholecystitis.	Fibrino-purulent.	Perforation of gall-bladder.	
9.	Perforated gastric ulcer.	Purulent peritonitis.	Fibrino-purulent pleuritis.	Streptococcus Bac. Coli.
10.	Perforated gastric ulcer.	Fibrino-purulent.	Bilateral purulent pleuritis.	—
11.	Perforated duoden. ulcer.	Fibrino-purulent.	Gastric ulcer. Abscess in lung and kidney.	Bacillus pyocyaneus.
12.	Acute gangrenous pancreatitis.	Purulent.	Cholelithiasis.	Streptococcus.
13.	Perfor. appendicitis.	Fibrino-purulent.	—	—
14.	do.	Acute purulent.	—	Staphylococcus aureus Streptococcus.
15.	do.	Purulent.	—	Streptococcus Bac. Coli.
16.	do.	Fibrino-purulent.	—	—
17.	do.	do.	—	—
18.	Gangrenous appendix.	do.	Perforation of intestine.	Bacillus Coli Streptococcus.
19.	do.	Purulent.	Chronic Salpingitis.	Pyocyaneus.
20.	Perforated ulcer of rectum.	Fibrino-purulent.	Old adhesions.	Bacillus Coli.
21.	Gangrene of bowel.	do.	Inguinal Hernia.	Streptococcus Bac. Proteus.

INFECTIONS FROM PELVIC ORGANS

Case.	Local Lesions.	Character of Peritonitis.	Complications.	Organisms.
22.	Purulent salpingitis.	Purulent.	Chronic pelvic peritonitis.	Pneumococcus.
23.	do.	Fibrino-purulent.	Chronic pelvic peritonitis.	Pyocyaneus.
24.	do.	do.	Acute bronchitis.	—
25.	Ruptured pyosalpinx.	Purulent.	Salpingitis.	Bac. Coli.
26.	Pyosalpinx.	do.		Streptococcus.
27.	do.	do.	Tubo-ovarian abscess.	do.
28.	Purulent salpingitis.	Gangrenous and purulent.		Bac. Coli. Staphylococcus aureus
29.	do.	Fibrino-purulent.	Purulent endometritis tubo-ovarian abscess.	Gonococcus Bac. Coli.
30.	Infected ovarian cyst.	Purulent.	Cyst communicating with bowel.	—
31.	do.	do.	Pulmonary tuberculosis.	Pneumococcus Bac. Coli.
32.	Sarcoma of ovary	Fibrino-purulent.	Chronic adhesive peritonitis.	do.
33.	Rupture of gangrenous bladder.	do.	Hydrosalpinx.	Staphylococcus aureus.
34.	Carcinoma uteri.	Purulent.	Salpingitis.	Streptococcus.

TUBERCULOUS PERITONITIS

Case.	Local Lesions.	Character of Peritonitis.	Complications.	Organisms.
35.	Ulceration of intestine.	Adhesive dry.	Perforation of intestine.	
36.	Tuberculous salpingitis.	do.	Pulmonary tuberculosis.	
37.	Tuberculous calitis.	General miliary.	Chronic appendicitis, pulmonary tuberculosis.	
38.	Tuberculosis of tubes, uterus and ovaries.	Fibrinous with some fluid.	Pulmonary tuberculosis.	

PERITONITIS IN PREGNANCY

Case.	Local Lesions.	Character of Peritonitis.	Complications.	Organisms.
39.	Acute hæmorrhagic endometritis.	Acute suppurative.	Acute suppurative endocarditis. Septic pneumonia.	Staphylococcus aureus.
40.	Abortion. Acute suppurative endometritis.	Acute purulent.	Acute suppurative salpingitis.	Pneumococcus.
41.	Premature labor.	Acute purulent.	Bilateral gonorrhœal salpingitis.	Bac. Coli, Streptococcus Gonococcus.
42.	Abortion. Gangrenous endometritis.	Acute purulent, with petechial hæmorrhages.	Acute yellow atrophy of liver.	Streptococcus B. capsulatus aerogenes.
43.	Acute exudative endometritis.	Acute plastic.	Salpingitis. Hydrosalpinx.	Streptococcus.
44.	Acute gangrenous endometritis.	General plastic.	Pyosalpinx.	
45.	Purulent endometritis.	Acute purulent.		Streptococcus B. Coli.
46.	Acute endometritis.	Acute purulent.	Abscess of cul-de-sac.	Streptococcus.
47.	Acute purulent endometritis.	Fibro-purulent.	Pericarditis.	Staphylococcus aureus.
48.	Acute purulent endometritis.	Acute purulent.	—	Streptococcus.
49.	Gonococcus endometritis.	Acute purulent, with multiple local collections.	Bilateral purulent salpingitis.	Gonococcus.
50.	Abortion.	Acute diphtheritic endometritis with suppurative infiltration of the uterine muscle.	Acute fibrino-purulent peritonitis. Embolic abscess of lungs and kidney. Ulceration of bladder.	Staphylococcus aureus.

of peritonitis of intestinal origin are due to the common pyogenic cocci which have been outgrown by the colon bacillus."

The circumstances of 241 operations for peritonitis are related by Noetzel (4). There were 165 cases of peritonitis after appendicitis with 81 deaths. There were 38 cases from inflammatory pelvic conditions. Five cases of puerperal peritonitis are recorded with 3 deaths. Diffuse peritonitis followed gall-bladder disease in 6 instances. Twelve cases followed perforated gastric ulcer and 11 cases were caused by perforated small intestine. Four cases are added from other causes.

These three studies comprise 338 cases of diffuse peritonitis in persons of both sexes. In 218 cases (67.4 per cent) the peritonitis was due to appendicitis. Gastric ulcer was a cause in 27 cases, bowel ulcer in 140, and infection of the gall-bladder in 8. Extension of infection from pelvic inflammatory disease caused diffuse peritonitis in 38 cases (11.2 per cent) of the combined series. Diffuse peritonitis associated with pregnancy or the puerperium is mentioned by only one of the three authors, so that this has no statistical value.

BACTERIOLOGICAL TABLE

	Infection From			
	Bowel	Pelvis	Pregnancy	Total
Streptococcus alone	3	2	4	18
do. mixed	5	1	3	
Bacillus Coli alone	4	2	–	13
do. do. mixed	3	3	1	
Staphylococcus aureus alone	–	2	3	6
do. do. mixed	1	–	–	
Pyocyaneus alone	2	1	–	3
do. mixed	–	–	–	
Gonococcus alone	–	–	1	3
do. mixed	–	1	1	
Pneumococcus alone	–	1	1	3
do. mixed	–	1	–	
B. capsulatus aerogenes mixed	–	–	1	1
Tuberculosis				4
Total cases studied bacteriologically	14	11	12	41

In these combined series it may be seen that the frequency of diffuse peritonitis from bowel lesions is relatively high, while that from pelvic causes is proportionately small. Puerperal diffuse peritonitis enters only into one series and that in very small percentage (1 per cent). The following series[1] of 50 cases of diffuse peritonitis will give a more exact idea of the frequency with which the various causes operate in the production of this lesion in women. These cases have been arranged with some idea of placing them into classes according to their main causes.

The consideration of these cases shows that there were 21 cases associated with bowel infection. Of these, 8 (16 per cent) followed appendicitis, 2 (4 per cent) followed perforated gastric ulcer. In the combined series of both series, appendicitis as a cause accounted for 67.4 per cent, showing that diffuse peritonitis from this cause is very much greater in men than in women.

Peritonitis from pelvic causes, apart from pregnancy, existed in 13 cases (26 per cent), in comparison with 11.2 per cent of the combined series; but, as the 12 cases associated with pregnancy are classified apart, this percentage is relatively greater, or 50 per cent.

Four cases of tuberculous peritonitis are included in the series, in order to make the series and discussion complete.

Peritonitis associated with pregnancy comprised 12 cases (24 per cent) of the series. The essential cause of peritonitis in pregnancy varied as did the infecting organisms.

Forty-one cases of the series were studied bacteriologically.

STREPTOCOCCUS PERITONITIS

The streptococcus has a relatively large place in this series, while the colon bacillus is relegated to second place. It may be that, in fatal cases, the streptococcus occupies this position because of the severity of its infection.

The great mortality of this condition makes it of immense importance to understand the processes of the affection. It is masked by severe clinical manifestations with little evidence of repair on the part of the peritoneum. Pus is usually very generally distributed throughout the abdominal cavity with little or no effort at repair in the distant parts, the gut is dry, glazed, and distended, and intestinal paralysis soon follows.

Streptococcus infection differs from most other infections in that the blood serum does not acquire streptococcidal properties, but the destruction of cocci and relief from the infection is brought about by the leucocytes. Phagocytosis is an important factor in recovery and, in addition to a leucocytosis, there must be an increase in the opsonin, i. e., an increase in the power which prepares the leucocytes to engulf the bacteria.

Streptococcus infection of the peritoneum occurs in two ways: 1. From any focus of infection, as rupture or perforation of the intestine, rupture of an abscess; 2. By extension of the infection through the lymphatics to the peritoneal cavity. This latter form is most frequently found in the puerperium, where extension of the infection is from the uterine cavity through the broad ligaments to the peritoneum.

STAPHYLOCOCCUS PERITONITIS

Staphylococcus infection of the peritoneum is another of the more common ones. It was found in this series in 6 cases. It is also a severe type and is marked by metastatic focal collections of pus in other parts of the body. Five of the 6 cases were caused by pelvic lesions and in three there were metastatic foci. In 2 cases of staphylococcus infection there was involvement of the heart or pericardium, once as an acute suppurative endocarditis and once as pericarditis.

The frequency of cardiac involvement in staphylococcus infection or staphylomycosis has only recently been recognized and Otten (5) has reported 55 cases of such infection in which endocarditis developed in 25 per cent. This is a striking contrast to the frequency of endocarditis as an association of streptococcus infection, in which it occurs in only a trifle over 4 per cent of the patients.

There may be a single metastasis in the form of an abscess of the liver, brain, or perineal tissues or there may be multiple small foci of pus. As metastatic abscess formation is the

[1] The majority of these cases were studied or are from the records of the Bender Laboratory.

rule, rather than the exception, constant care in examination of the patient should be taken in this form of peritoneal infection.

BACILLUS COLI PERITONITIS

Colon infection of the peritoneum does not occupy as large a place as it does in Dudgeon and Sargent's series. It is usually the result of bowel infection and is marked by large amounts of pus which has often a fetid odor.

GONOCOCCUS PERITONITIS

Gonococcus infection of the peritoneum is rare and the course is not usually severe. In one case, it was found in pure culture and was the result of old gonorrhœal salpingitis. On the third day of the puerperium, the temperature went to 101° and pulse was 96. Pain, rigidity, and vomiting, with a temperature of 103 degrees, appeared on the fifth day. On the sixth day indefinite masses in the abdomen and pelvis were made out, on abdominal and vaginal examination. The pulse at this time was 120. Operation was refused. Death occurred on the seventeenth day. Autopsy, showed a bilateral purulent salpingitis and general peritonitis of some duration. Collections of pus were found encapsulated by the intestines and adhesions in various parts of the abdomen.

In the other two cases, the gonococcus was associated once with the streptococcus and once with the colon bacillus. The pulse rate in this form of infection usually increases more rapidly than in the other forms of peritonitis. Rigidity and tenderness are usually marked. Pressure upon the abdomen and movement of the uterus in vaginal examination cause pain. There is often a characteristic tenderness in the posterior roof of the vagina. Recovery is the rule.

PNEUMOCOCCUS PERITONITIS

Pneumococcus peritonitis occurred in this series three times, once associated with pregnancy. It is one of the more uncommon forms of peritonitis and of comparatively slight severity, save in isolated cases. A number of cases have been recently reported. Weichselbaum (6), Bar, and Tissier (7) have reported cases similar to these. That the condition is by no means rare, however, is shown by Armand and Bowen's collection of 91 cases of pneumococcus infection in children. They found that in half the cases the pus was encysted and that the peritoneal infection was usually secondary to some remote pneumococcal lesion. The exhaustive discussion by Jensen (8) of this form of peritonitis gives a very thorough idea of the subject. He reports several very interesting cases with a list of 143 references.

This form of peritoneal infection is characterized by a plastic exudate, very rich in fibrin, which causes adhesions and encapsulation of the exudate; quite rarely in the severer forms, the entire mass of the intestines adheres together and is surrounded by pus. In typical cases, the clinical picture is quite striking: the onset is that of an acute peritonitis followed very soon by a chronic stage with mild symptoms and indefinite masses on abdominal palpation. The diagnosis is never, however, certain without bacteriological examination, although one might suspect this infection from the thin, odorless, greenish yellow pus and the abundant fibrinous adhesions. The process is very similar to that of gonococcus peritoneal infection. Prognosis is, as a rule, favorable; but recovery without operation is rare.

TUBERCULOUS PERITONITIS

Tuberculosis of the peritoneal cavity according to Cummins (9) occurs in 3 per cent of all autopsies; and of all forms of peritonitis 25 per cent are tuberculous. Females, however, are much less subject to it than males. Genital tuberculosis is responsible for 40 per cent of the cases in females. The average mortality is about 3 per cent. The primary focus of the disease is usually to be found and the peritoneal involvement is greatest in extent near the seat of local infection. According to Douglas (10), Borseke failed to find the primary focus in 2 of 226 cases. The fibrous form of the disease gives the greatest percentage of cure and the ulcerative the smallest. Goeschel (11) has reported 19 cases with 3 cures and a number of others improved.

There are two kinds of lesions in this condition, those in which the peritoneum is alone involved and those in which there is a generalized infection of both surfaces of the intestine.

Laparotomy is often of value in the separation of constricting adhesions which narrow or occlude the intestine or in the separation of agglutinated masses of bowel.

Diffuse peritonitis may also be caused by perforation in the course of a tuberculous intestinal and peritoneal process, as occurred in one case reported here and in 26 cases collected by Herara and Patel (12). Any aggravation of the condition in a known intestinal tuberculous infection should suggest this condition. Pain is significant, but it may lessen in severity or disappear. It, however, usually recurs and may be elicited by palpation. The lack of harmony between the pulse and the temperature, slight meteorism, rigid abdomen, and extension of the areas of dullness, are all suggestive, when accompanied by vomiting. Operative treatment offers little hope. Search for the perforation is usually hopeless on account of its small size and the fact that it is usually hidden by a serous covering.

PERITONITIS IN THE PUERPERIUM

The effect of pregnancy and the puerperium upon peritonitis is very marked. The pregnant or recently pregnant woman is more susceptible to infection, in general, than the non-pregnant and is prone to disturbances of metabolism which lessen resistance and decrease elimination. All grades of toxæmia of pregnancy render the patient more susceptible to infection. The traumatism of labor causes a local disturbance of circulation and the raw surface of the uterus bares a huge area for the entrance and growth of microorganisms which may pass to the peritoneal cavity.

Peritonitis in the puerperium may be divided into the two forms: that form from a previous focus of infection, and lymphatic peritonitis. In the first class, the organism does not pass through the genital canal, but is the result of the lighting up of a previous focus of infection. Into this class, fall all cases of infection from bruising of tumors, infection of ovarian cysts, and rupture of pus tubes or purulent collections about the adjacent pelvic organs. Any variety of pelvic tumor may have its blood supply cut off and become inflamed and gangrenous, thus causing a peritonitis. The important point to recognize is that the pelvic lymphatics are not involved and that the treatment is that of non-puerperal peritonitis. However, it frequently happens that there may be associated two infections, one of which is of the nature of a lymphangitis and the other is the old focus lighted up. This occurred in case 41, where an old purulent gonorrhœal salpingitis became reinfected with streptococcus by lymphatic extension and ruptured, causing diffuse peritonitis.

There is, in this series of cases, no instance of peritoneal infection resulting from direct traumatism, as necrosis of tumor from pressure or torsion of the pedicle. A fibroid may take on sudden growth during pregnancy and, from torsion of the pedicle or sudden loss of nourishment from lessening of the blood supply after labor, become necrotic and infected.

Similar causes lead to infection from ovarian cysts. Getter (13) has reported 21 cases where, in spite of normal labors, infection of the cyst has occurred and led to fatal peritonitis. The infection is usually widespread and severe and commonly due to the colon bacillus. Patton (14) has collected 321 cases of ovarian cysts in pregnancy. In 95 cases treated expectantly until labor, torsion of the pedicle occurred 29 times — 4 times during labor and 25 times during the puerperium. Rupture happened 13 times — 3 before and 10 after or during labor. There were 25 deaths in the 95 cases, only 4 of which had operations after labor and 21 in those who were treated expectantly. Diffuse peritonitis occurred in 7 of the 95 cases. There were, on the contrary, 184 cases treated by operation with a mortality of 8 (4.3 per cent). Infection of ovarian cysts is especially liable to occur in the early puerperium.

Appendicitis is another lesion which may cause an extensive and fatal form of peritonitis in pregnancy. The lessened resistance of the pregnant woman has added to it the local disturbance of the presence of the mass of the gravid uterus and the increased vascularity of the pelvic viscera. The growing pregnant uterus pushes up the cæcum and appendix. This displacement begins about the fourth month when the uterus rises out of the true pelvis. It then opens up the broad ligaments and the ovarian vessels are enormously increased in size. This elevation of the cæcum is

of clinical significance as, in addition to the predisposition to disease, by the alteration of position, the focus of inflammation is thereby placed in a more dangerous position, i. e., higher in the abdomen where adhesions are more easily torn and where inflammatory processes spread with greater ease. The cæcum returns to its proper place after labor: but, if the appendix is adherent, it is dragged into the true pelvis by the involution of the uterus. This may cause rupture of an abscess or increase the extent of this inflammation to the general peritoneum. Futh (15) states that appendicitis is much more dangerous after the fourth month of pregnancy on account of the size of the uterus influencing the position of the cæcum. He has divided Boije's series into two groups. In the first, under four months, there were 10 cases with 3 deaths; in the second, from the fourth to ninth month, there were 32 cases with 19 deaths — a much higher mortality. This seems clear proof of the effect of the continuance of pregnancy upon this condition. Hlawecek (16), in 1897, collected 13 cases of peritonitis from this cause with 11 deaths; but, with early operative treatment, the prognosis is brighter.

Lymphatic peritonitis is the result of infection in the genital canal passing through the softened uterine and pelvic tissues to infect the peritoneum. This form of peritonitis is usually strepococcus infection and is marked by its severity. It follows the course of a lymphangitis elsewhere in the body, save that it is modified by an adjacent serous cavity — the peritoneum. The broad ligaments are thickened often to three fingers' breadth, and pus will sometimes exude from the cut surface of the lymphatics of that region.

DIAGNOSIS

The diagnosis of diffuse peritonitis is often a task of no mean order. This is usually difficult when it is a question whether a previous infection has extended to the peritoneal cavity. It is particularly difficult in puerperal peritonitis when a woman already severely infected, shows few additional symptoms and small increase of pathognomonic signs.

Rigidity is usually an early and marked symptom and is present in all cases at their inception. It is a local evidence of the irritation of the sensory nerves of the parietal peritoneum and depends upon special chemical conditions. The more intense the toxic action, the greater the rigidity. If it occurs on both sides of the abdomen, the peritonitis will have extended to both sides of the peritoneal cavity. This is borne out by a study of Barth (17), who found in 117 cases that when the rigidity was on one side, the inflammatory process was also limited to that side. Rigidity is most marked in sudden and rapidly spreading peritonitis, as from appendicitis, and is usually slight or transient in cases following pelvic disease or in puerperal peritonitis. After labor, the relaxed abdominal walls of the puerperal patient do not easily become rigid and intestinal distension readily overcomes it. It is usually present at the inception, however. To the educated hand of the surgeon, rigidity is the most reliable early symptom.

Pain is usually a prominent symptom. The pain of peritonitis is fairly characteristic and is a great aid in the diagnosis of the condition. It depends upon two conditions: First, it is now recognized that most of the pain of peritonitis is due to the accompanying lymphangitis. This, in part, causes the crampy pains of peritonitis — the lymph vessels of the intestines press upon the sensory nerves as the lymphangitis extends. The pain of peritonitis is often not localized, but is sometimes referred, like that of appendicitis, to the epigastrium. This is supposed to be due to the infection in the perilymphatic tissue and lymph glands around the aorta.

The second source of pain is from the exterior of the gut itself and is due to the presence of an irritant causing inflammation of the peritoneum. Movement of the intestine causes severe crampy pains. In addition to the direct irritation and inflammation of the peritoneum, pain is further caused by the rubbing of the inflamed intestinal covering against the parietal peritoneum. The visceral serosa is comparatively free from sensory nerves, while the parietal peritoneum is exceptionally well supplied. It is also recognized that peritonitis may exist in the center of the belly beneath the colon and above the pelvis, amongst the coils of small intestine, for some time and

become widespread without causing marked pain.

That acute abdominal symptoms may be caused by lymphangitis alone is shown by a report of Rowland (18) of two cases of operation upon supposed perforation in typhoid fever. Masses of elongated lymphatic glands were found in the mesentery of the gut without any evidence of perforation of peritonitis. The pain was intermittent and peristaltic. There was localization of the tenderness with little or no rigidity. Armstrong has reported a similar case in typhoid fever; and McCrae in his study of the pain in typhoid fever cites two cases in which the explanation of the acute symptoms was the enlarged mesenteric glands.

Tenderness on palpation is not usually a marked symptom, unless there has been some effort at repair with the formation of exudate and adhesions. For this reason it is usually slight in puerperal diffuse peritonitis and marked in the less acute forms as pneumococcus and gonococcus peritonitis. The tenderness elicited in gonococcus peritonitis by vaginal examination has already been referred to.

Vomiting is a constant symptom of peritonitis and occurred in all of Barth's 117 cases. It may be divided into two classes: that which occurs at the onset of the disease and is regurgitative and the later and more persistent, bile-stained vomiting, often fæcal or hæmorrhagic. It usually recurs and persists as the inflammation spreads over the peritoneum.

The temperature invariably shows a rise and is usually high. In infection with the more virulent organisms the rise is high and intermittent; but in less virulent, as gonococcus peritonitis, the temperature is no so high — not rising above 103 degrees in the cases reported here. The pulse rate, however, in gonococcus peritonitis is usually out of proportion to the temperature. There is, however, nothing characteristic about the less virulent peritonitis. The pulse is usually a better indicator of the condition of the patient than is the temperature.

The blood changes of diffuse peritonitis are interesting and instructive. There is usually a diminution in the red cells. This is more marked in puerperal peritonitis and in puerperal infections generally, than in the non-pregnant. The leucocytic count is increased, as it is in all septic conditions. This depends upon the patient's resistance and the virulence of the infection. It may be said, as a general rule, that the leucocyte count is less in the pregnant than in the non-pregnant. The polymorphonuclear leucocytes are usually increased in percentage.

Iodophilia is a rather useful sign and gives reliable evidence in septic conditions. After staining with weak solution of iodine (Ehrlich's method), the blood in cases of septic infection usually shows a reaction in the cytoplasm of the leucocytes. This iodophilia usually occurs in the polymorphonuclear neutrophile cells and sometimes in the lymphocytes. It does not bear any definite relation to the leucocytosis, but it depends on the amount of toxæmia, not on the leucocyte range. Thus, the blood of a profoundly septic person may show intense iodophilia with a fall in the leucocyte count; while a high leucocytosis without iodophilia, is not incompatible with an infection exciting a toxæmia sufficient to stimulate the cells to production, but not of a character to affect them structurally. This fact makes the reaction especially valuable in cases of rupture of an abscess or puerperal peritonitis, where there is often sudden overpowering of the system by toxins. An interesting review of the subject, with report of 50 cases of sepsis, is given by Da Costa (19). It is to be remembered, however, that the diagnosis of peritonitis can never depend upon the blood changes which only give confirmatory evidence of infectious processes. No hard and fast rule in regard to the amount of leucocytosis can be laid down.

The treatment of diffuse peritonitis in women differs but slightly from the treatment of this condition in men. The much larger number of cases in men (67.4 per cent in the combined series), resultant from appendiceal disease, compared with the smaller number in women (16 per cent in this series), indicates that women are less susceptible to peritonitis from this cause; while the pelvic causes (50 per cent in this series) have a relatively greater place. These facts have a bearing upon the treatment of peritonitis in women. The cause of the peritonitis being pelvic in origin, in half of the cases, it is possible that vaginal and pelvic operation might eradicate the focus of disease

without disturbance of the upper part of the abdominal cavity.

Again, in diffuse peritonitis of the lymphatic type, associated with pregnancy, it is often impossible to eradicate any one focus of infection; and abdominal operation, beyond the relief of tension, gives but little help in the cure of the disease. It is possible that this type of peritonitis is best treated by the expectant method with abstinence from food or liquids, rectal feeding, and saline infusions by the bowel until the condition becomes localized or cured.

It is to be remembered that, as Lennander says, "It is the infection which kills and the peritonitis which saves."

In cases where the focus of infection, such as an infected ovarian cyst or a ruptured pus tube, can be removed, it seems only reasonable to prevent the addition of infective material by its removal with as little operative trauma as possible.

The Fowler-Murphy method by elevation of the head and rectal infusions by the gravity bag are great factors in the successful treatment of such cases.

However, while operative measures may remove the focus of infection, they can do but little toward the relief and absorption of the peritoneal pus remaining in the abdominal cavity. The encouraging results of Mickulicz (20), Hanner (21), Chantemesse and Kahn (22), in the use of nucleic acid and nucleinate of soda as a means of fortifying the body resistance to resist the infection and as a means of increasing the leuocytosis, should not be overlooked.

The use of vaccines and sera have but a limited field owing to the acute type of the lesion. However, Bumm (23), Rau (24), and Escherich (25) have reported good results from the use of the improved polyvalent anti-streptococcus serum, and its use does no harm. It should certainly be given a trial in all cases of streptococcus peritoneal infection. Again, the very successful results reported in the use of staphylococcus vaccine in infections in other parts of the body make its use indicated in the more prolonged staphylococcus peritoneal infection for the cure of the disease and the prevention of metastatic abscesses.

The operative treatment of diffuse peritonitis is limited in scope to the removal of the focus of disease with as little trauma as possible and can offer but little further hope as to cure of the peritoneal infection itself, as this cannot be eradicated or removed by surgical means. The attention of surgeons and investigators must now be directed to the increase of resistance against infection, the fortification of the body defenses, and in aiding the cure of the septic processes and lesions. In this study, the extent and character of the infection and its examination by blood cultures etc. are of the greatest importance.

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THE RELATION OF THE LESION IN APPENDICITIS TO THE LEUCOCYTE COUNT

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LEUCOCYTE examinations of themselves in acute surgical disease may prove dangerous and unreliable, but when taken in conjunction with the history and physical signs may prove of inestimable value and of preponderating worth in diagnosis, but still leave us in doubt when clinical surgery is divorced from laboratory findings. A wide experience with the conclusions established by laboratory methods of investigation is absolutely essential for correct interpretation. The limitations and advantages must be well balanced and the leucocyte count will not only aid in differential diagnosis, but will be seen to bear some relation to the extent of appendicular inflammation. These results are submitted to increase the sum total of data relating to the subject and represent a study of 278 cases.

CLASSIFICATION OF LESIONS

For the purpose of this paper it has been deemed best to arrange the lesions of appendicitis, the results being corroborated by operative findings, as follows:

I. Acute.
A. Gangrenous perforative.
   1. Local peritonitis with abscess (pus with limiting adhesions).
   2. Spreading peritonitis (free pus confined to lower right quadrant or right or lower half of abdomen).
   3. Diffuse septic peritonitis.
B. Non perforated (without pus).
   1. Gangrenous.
   2. Inflamed.
II. Subacute (inflamed without pus).
III. Chronic (inflamed without pus).

In view of the fact that it is often difficult to determine just the degree of peritoneal involvement, the term "diffuse" has been adopted instead of "general." It includes, then, cases in which free pus is present involving the parietal and visceral peritoneum to a greater or less extent.

Series I	Diffuse Septic Peritonitis	Spreading Peritonitis	Localized Abscess	Without Pus				Total	Percentage
				Gangrenous Appendix	Acutely Inflamed	Subacutely Inflamed	Chronically Inflamed		
Less than 10,000	1	2	7	1	4	6	18	39	13.6
10 to 15,000	12	12	35	4	13	2	8	86	30.9
15,000 to 20,000	9	11	16	5	14	4	6	65	23.3
20 to 25000	5	8	23	4	4	0	0	45	16.5
25 to 30,000	7	5	10	1	2	0	0	25	8.9
30 to 35,000	1	3	3	0	1	0	0	8	2.8
35 to 40,000	0	4	1	0	0	0	0	5	1.7
40 to 45,000	1	1	0	0	0	0	0	2	0.7
45,000 plus	2	1	0	0	0	0	0	3	1.04
Total	38	47	95	15	38	12	33	278	99.54
Highest	55,600	42,200	35,000	29,400	31,200	16,800	12,000		
Lowest	9,700	9,200	7,600	8,000	7,200	6,200	4,300		
Average	32,750	25,700	21,300	18,700	19,200	16,500	11,150		

THE NUMERIC COUNT

Diffuse peritonitis. In series I, the total count varies between 9,700 and 55,600. The variation has been interpreted as indicating corresponding resisting powers. The case in my series with the highest count died as did that with the lowest. There were no complications in these two cases. If we take a high count to mean a good reaction on the part of the body, our hypothesis fails in this case. Of thirty-eight cases, 2 .6 per cent had less than 10,000; 31.3 per cent were between 10 and 15,000; 23.6 per cent between 15 and 20,000; 13.1 per cent between 20 and 25,000; 18.4 per cent between 25 and 30,000; 2.6 per cent between 30 and 35,000 and 7.8 per cent over 40,000.

Hence, it is seen that the mere presence or absence of leucocytosis would be per se more

often misleading as to the extent of the involvement than useful, as it does not necessarily indicate the character of the lesion.

Spreading peritonitis. Of 47 cases, 4.2 per cent were under 10,000; 25.5 per cent between 10 and 15,000; 23.4 per cent between 15 and 20,000; 17 per cent between 20 and 25,000; 10.6 per cent between 25 and 30,000; 10.6 per cent between 30 and 35,000; 8.5 per cent between 35 and 40,000; 4.2 per cent over 40,000.

The second column shows the highest count to be 42,200, the lowest 9,200, also a wide variation. We might suppose, taking leucocytosis to be indicative of resistance, that the numeric count would show a higher average before an overwhelming infection has time to occur than in diffuse, but it is possible to conceive that one person may combat a diffuse septic peritonitis better than another may a spreading lesion, although this lesion for a particular individual may prove more severe than a diffuse peritonitis for another person.

Diffuse peritonitis shows an average of 32,750, spreading of 25,700. The degree of absorption must be considered as well as the extent of peritoneal surface invaded.

Localized peritonitis. In these cases it is with a local pus focus that we have to deal. Ninety-five cases were studied; of these, 7.2 per cent were below 10,000; 36.8 per cent between 10 and 15,000; 16.8 per cent between 15 and 20,000; 24.2 per cent between 20 and 25,000; 10.6 per cent between 25 and 30,000; 3 per cent between 30 and 35,000; 1.1 per cent between 35 and 40,000. The lowest count compatible with an abscess is 7,600, the highest 35,000, or an average of 21,300. The variation we attribute to different degress of septic absorption. It is hardly conceivable that all cases are equally well walled off; even so, it may be possible, all things being equal, for some cases to absorb more septic material than others. Individual resistance to absorption—that unknown personal equation—still remaining an immeasurable quantity, we may conclude that when resistance and absorption are equally balanced we have a high leucocytosis; when absorption is greater and the leucocytes do not meet the requirements of the case when reaction is poor, they are but slightly altered in number, having been overcome in the struggle, or else there is no absorption and hence no leucocytosis.

Grangrenous appendicitis; non-perforative without pus. But a limited number of these lesions have been observed by the writer. Of these 15 cases, 6.6 per cent were under 10,000; 26.4 per cent between 10 and 15,000; 33 per cent between 15 and 20,000; 26.4 per cent between 20 and 25,000; and 6.6 per cent between 25 and 30,000. This form of inflammation usually gives a greater chemotactic stimulus as indicated by leucocytosis than does the milder acutely inflamed. The highest count observed is 29,400, the lowest 8,000, the average being being 18,700. In taking an average thus far of counts in various lesions, numeric counts decrease proportionately with degree of infection.

Acutely inflamed. This includes catarrhal, interstitial, diffuse, etc., without pus, or demonstrable macroscopic intramural abscess. It is not the custom to section and examine microscopically appendices in this hospital, as they are claimed by the operators and examined in the gross. 38 cases were studied; of these 10.4 per cent showed less than 10,000; 34.1 per cent between 10 and 15,000; 36.8 per cent between 15 and 20,000; 10.4 per cent between 20 and 25,000; 5.2 per cent between 25 and 30,000; 2.6 per cent between 30 and 35,000. The highest observed was 31,200, the lowest 7,200, making an average of 19,200.

It will be noticed that the average is higher for this lesion than for the gangrenous inflammation and the proportionate decrease the writer had hoped to show is here upset.

Subacute. But little attention has been paid to this and to chronic lesions. Of the former, during an acute attack, the highest was 16,800, the lowest 6,300 taken at the interval, or an average of 16,500; all showed less than 20,000. In none of these nor in the chronic was pus present. Chronic cases show an average of 11,150, the highest being 18,000 during an exacerbation, the lowest being 4,300 taken at the interval. All interval cases without pus show a normal count.

REVIEW OF THE VALUE OF THE NUMERIC COUNT (CABOT) (1)

1. Mildest and severest lesions may show no leucocytosis. Six cases with diffuse septic

peritonitis showed no increase. Total absence of an increase in a case not obviously mild is a very bad prognostic sign.

2. An increasing leucocyte count means a spreading process and may be the only evidence of the fact. A steady increase is always a bad sign, and should never be disregarded, even when other bad symptoms are absent. It is of far more significance than a larger count which does not increase.

3. The actual number of leucocytes is of comparatively little value. A low count presents one of three alternatives:

a A mild case.

b A very severe case.

c A well walled-off pus focus without absorption.

In case of a well walled-off abscess which has ceased to spread the count remains stationary or decreases. If the abscess bursts and causes a spreading peritonitis, or a diffuse septic peritonitis, the count may fall if it is an infection of overwhelming severity in the face of decreased resistance, or may show a moderate or marked increase, depending upon the resistance which the system offers.

4. In the majority of cases pus is neither free nor well encapsulated. Such cases are accompanied by a moderate and fluctuating leucocytosis, which rises and falls according to a variety of conditions which cannot be accurately determined.

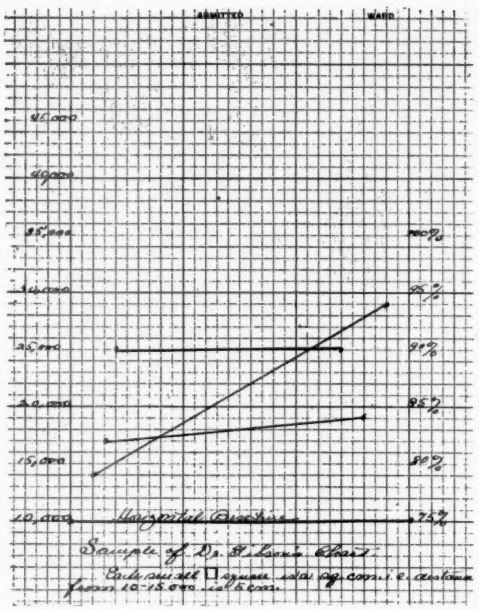
5. A maintained count of 18 to 25,000 usually means a well walled-off abscess.

6. *a* Acute cat. appendicitis (without pus). Twenty-two cases studied. In only one case a count of 22,000 which fell to 11,000 in 24 hours. In two cases counts of 17,000 which fell to normal in 48 hours. Nineteen others were lower. DaCosta's (2) series of 38 cases showed four counts above 15,000.

b Gangrenous appendix. Ten cases studied, 20,000 or over.

c Empyema of appendix. Four cases studied as in *b*.

d Well-encapsulated abscess. Bloodgood (3) found in 14 of his cases (26 per cent) counts between 6 and 12,000. Eleven were chronic, three presented acute local symptoms, presumably unable to react. In 9 cases of subacute and chronic with palpable tumor,



counts ranged between 12 and 15,000. In 33 cases (63 per cent) he found a leucocytosis between 15 and 60,000. All showed over 18,000 during the first twenty-four hours.

7. *Appendicitis with diffuse septic peritonitis.* Counts were shown to be high or low. Bloodgood (3) cites four fatal cases of at least three days' duration, two of 11,000, one of 13,000 and one of 14,000. He concludes that "in the early hours of peritonitis there is a rapid rise which however soon falls." He concluded that a leucocytosis of 18,000 within the first 48 hours should be considered an indication for operation, especially when we have a chart showing a rising count. If below 18,000 and falling, the patient is recovering from the attack. Between the third and seventh day, a count of 18,000 or more was usually considered an indication for immediate operative interference, but in some cases, local signs may have persuaded the surgeon to postpone the operation.

The above was essentially the opinion of the majority of surgeons, thus: Longridge (4) in England, Kühn (5) and Coste (6) in Germany, and Locke (7) in this country were practically of the same opinion. Joy and Wright (8) in

a study of 124 cases placed special emphasis upon the good prognostic significance of a falling leucocyte count. In such cases, unless accompanied by unmistakable signs of a generally bad condition, it has been deemed best to postpone operation, while a high stationary, or increasing count indicated a serious progressive case which demanded immediate intervention.

Curshmann, Kuttner, and Dützman expressed similar views at the 31st German Surgical Congress in April, 1902. Kuttner insisted upon at least two counts a day being taken, and controlled them with the iodine reaction. He took advantage of the above to distinguish between post-operative wound fever and pus pocketing. Curshmann believed a count of 25,000 or more suspicious of pus, but, like recent observers, deprecated isolated counts, and advocated leucocyte charts. From the German quotations it appears that they went through the same mental metamorphosis in 1902 that American surgeons experienced a decade before. It was Grawitz who warned German surgeons against falling into the error made early in this country, namely, that of supposing that leucocytosis always meant pus. In this country it was Deaver (9) who sounded the warning against the tendency to substitute the laboratory for the bedside as the point of vantage to make the diagnosis. Da Costa's (2) findings were practically those of Cabot (1), Richardson (10), Gulland, and French (11) in Great Britain, Gerngross (12) and Federmann (13) in Germany, Stadler (14) in this country, and Crazin and Gros in France.

To sum up, then, the current ideas which then prevailed, the words of Dr. Da Costa are extremely fitting and to the point: "The surgeon who attempts to use the blood count in appendicitis as a definite pathognomonic sign will soon run afoul of diagnostic disasters, but he who regards it only as a symptom invariably to be correlated with equally if not more important clinical manifestations, cannot fail to find this method of inquiry of signal value in routine clinical surgery."

PERSONAL CONCLUSIONS

The writer's experience from a study of 278 cases is in accord with the conclusions of other observers.

1. One may conclude from an absence of leucocytosis, where from the severity of the symptoms it would naturally be expected, that it is a serious indication and justifies an unfavorable prognosis; on the other hand, in an evidently favorable case it means a mild lesion.

2. When there is no increase or a moderately low count, the explanations are: (a) mild infection resulting in a scarcely appreciable alteration; or (b) the infection may be so severe that body resistance is powerless to act; or (c) in cases of some duration, as in a well walled-off pus focus, cessation of absorption and the shutting off of the mechanism of leucocytosis from the absence of a stimulus. Hence, the necessity of weighing signs and symptoms, and with their aid the alternative may be determined. More than this we cannot say and in summing up its value and significance we can only state that the numeric count per se in appendix disease is subject to such great variation that we can predicate nothing from it alone in an individual case. The increase formerly supposed to be proportionate to the severity of the lesion often fails when we are in the face of an overwhelming infection which the body is incapable of combating with its lowered vitality. In such cases toxic absorption occurs to such an extent that chemotactic and phagocytic action are inhibited.

Finally, it does not reflect the character of the lesion in an individual case and hence is not a reliable guide. In view of these facts, it remains for us to probe farther and at least attempt an elucidation, replacing old methods with the newer and more reliable ones about to be detailed.

THE DIFFERENTIAL COUNT

The estimation expressed in percentage of the various kinds of leucocytes from the stained smear, has been resorted to for the last five years. In inflammatory processes it is with the polynuclear neutrophile that we are chiefly concerned. For the purposes of this paper, 75 per cent will be considered the extreme limit occurring in health. Transitional forms are classed with these. In general terms, the number of polynuclear neutrophiles may be considered a fair index of the severity of the lesion. It possesses an advantage over the numeric estima-

tion in that it is influenced by a single factor, i. e., an inflammatory process and not directly by individual resistance. It will be seen that per se this estimation gives further insight into the abdominal condition than does the numeric count alone.

Series II	Diffuse Septic Peritonitis	Spreading Peritonitis	Localized Abscess	Without Pus				Total	Percentage
				Gangrenous Appendix	Acutely Inflamed	Subacutely Inflamed	Chronically Inflamed		
Less than 70	0	0	2	0	0	6	13	21	7.5
70–75	0	1	5	1	2	2	6	17	6.1
75–80	3	2	13	1	6	1	8	34	12.2
80–85	3	11	25	1	9	2	5	56	20.1
85–90	17	24	36	6	14	1	1	99	35.8
90 plus	15	9	14	6	7	0	0	51	18.3
Total	38	47	95	15	38	12	33	278	100.0
Highest	97	93½	95½	95	94	86½	87		
Lowest	75½	82½	72	73½	74	61	52½		
Average	86¼	88	83¼	84¼	84	73¾	68¾		

Diffuse septic peritonitis. In no cases were the polynuclears below 75 per cent; in 7.8 per cent between 75 and 80 per cent; in 7.8 per cent between 80 and 85; in 44.7 between 85 and 90; in 39.5 per cent above 90. In a total of 38 cases in 84.2 per cent the counts were above 85, the highest being 97, the lowest 75½, an average of 86¼.

Spreading peritonitis. The polynuclears were in 2.1 per cent of the cases between 70 and 75; in 4.2 per cent between 75 and 80; in 23.4 per cent between 80 and 85; in 51 per cent between 85 and 90; in 19.1 per cent above 90. Of 47 cases observed 74.4 per cent showed a polynucleosis above 85, the highest being 93½, the lowest 82½, an average of 88.

Local abscess. In 2.1 per cent of the cases observed, the differential count showed the polynuclears to be below 70; in 5.2 per cent between 70 and 75; in 13.6 per cent between 75 and 80; in 26.3 per cent between 80 and 85; in 37.8 per cent between 85 and 90; in 14.7 per cent above 90. Of 95 cases studied, 52.6 per cent were above 85, the highest being 95½, the lowest being 72, an average of 83¾.

Of fifteen cases of *gangrenous appendicitis* without pus, 6.6 per cent were between 70 and 75; 6.6 per cent between 75 and 80; 6.6 per cent between 80 and 85; 40 per cent between 85 and 90; and 40 per cent over 90; the highest 95, the lowest 75½, an average of 84¼. 80 per cent of these cases were over 85.

Acutely inflamed (without pus). No cases showed below 70; 5.2 per cent between 70 and 75; 15.7 per cent between 75 and 80; 23.6 per cent between 80 and 85; 36.8 per cent between 85 and 90; 18.4 per cent over 90. Of 38 cases, 55.2 per cent were above 85, the highest 94, the lowest 74, an average of 84.

Subacute appendicitis (without pus). Of 12 cases, 50 per cent were below 70; 16.6 per cent between 70 and 75; 8.3 per cent between 75 and 80; 16.6 per cent between 80 and 85; of 12 cases 91.6 per cent were below 85, the highest 86½, the lowest 61, an average of 73¾.

Chronic appendicitis. Of 33 cases, 96.9 per cent were below 85; the highest 87, the lowest 52½, an average of 68¾.

REVIEW OF THE LITERATURE

In 1903, Dr. R. N. Wilson (16), of Philadelphia, dealt with the subject in an emphatic and masterful manner. He considered 80 to 85 per cent as a suspiciously high per cent in the absence of an absolute leucocytosis, over 90 still more indicative of active and grave inflammatory processes, and usually suggestive of purulent effusion. Five years ago he pointed out that, if absolute leucocytosis disappears and relative polynucleosis continues, we have a warning of overtaxed powers of resistance, and, as all powers eventually give way, even the polynuclear increase must diminish, indicating the last sign of worn-out energy.

Dr. Wilson (16) writes that he had never observed cases of encapsulated abscess that failed to present a polynuclear increase. By referring to series II, it is seen that the author has noted 7 cases below 75 per cent. It is concluded from this that the interior of the body presents riddles that cannot be deliberately solved, and realizing this the dangers of blood study are lost.

We should take it purely as a sign, remembering that a pleural effusion does not always obscure the breath sounds. Dr. Wilson care-

fully emphasized the pitfalls. He attributes greater clinical value to the bedside with the history and signs than to the laboratory.

Dr. F. Sondern (17), of this city, further emphasized, in 1906, that leucocytosis is largely dependent upon body resistance toward infection, and therefore the degree of increase can be no guide to the intensity of the pathologic process. He pointed out the fact that the absence of an accurate clinical method to determine this was the keynote to the disappointment encountered in utilizing these counts in diagnosis. He concludes that:

1. A count below 70 per cent of polynuclears with an inflammatory leucocytosis of any degree excludes the presence of pus or gangrene.

2. Relative polynucleosis, even with little or no inflammatory leucocytosis, is still an absolute indication of the inflammatory process and the percentage is a direct guide to the severity of the lesion. In adults a purulent exudate or a gangrenous process is decidedly uncommon with less than 80 per cent of polynuclears, and the probability of their presence increases with the percentage. Eighty-five per cent of poynuclears or over was never seen, in his series, without a purulent or gangrenous process, irrespective of the leucocyte count. Ninety per cent always indicated a very severe infection; one case showed 95.2 per cent with recovery following operation. All other cases over 94.5 per cent resulted fatally.

Noehren (18) recently studied 60 cases of acute appendicitis in which differential counts were made; 13.3 per cent were over 90 per cent; 31.6 per cent between 85 and 90; 20 per cent between 80 and 85 per cent; 21.6 per cent between 75 and 80 per cent; 13.3 per cent under 75 per cent. (8 cases, 4 local abscess, 4 acutely inflamed.)

He concluded: 1. Every case above 90 per cent demands immediate operation. 2. Every case under 80 per cent could probably wait, being either a local abscess or an acutely inflamed appendix, except in two cases of gangrenous appendicitis, both of which had 78 per cent. Therefore, he takes 78 as the lowest count to postpone operating, counts below being mild or "safe" processes, and between these two, 90 and 78 per cent, the higher the per cent the more likely is the process to be a severe one, without, however, excluding the possibility of mild or safe processes.

PERSONAL CONCLUSIONS

1. A polynucleosis in the presence of appendicular lesions does not necessarily mean pus, gangrene, or severe inflammatory lesion. It has been observed in the writer's series to be as high as 90 per cent in seven cases of simple, acutely inflamed appendices, independent of pus or gangrene, the highest of these being 94 per cent.

2. Pus may be so well encapsulated (7 cases) as not to be sufficient stimulus to cause polynuclear increase. These cases do not represent overtaxed powers of resistance, as is seen in diffuse septic peritonitis, for example, in which case early in the disease there is a high polynucleosis which diminishes as the resisting powers are undermined.

3. Spreading peritonitis and early stages of a diffuse infection show a high polynucleosis. Later, in the latter part they may be low; the lower the worse the prognosis. When low, the outlook is extremely unfavorable as it indicates that one of the last barriers of defence has been broken down. Of 3 cases below 80 per cent, 2 died, one with 77 per cent, another with 78 per cent; the third with 73½ per cent recovered, being a very exceptional case. The differential counts per se in such cases are valueless in reflecting the character of the lesion, but of aid from a prognostic point of view when we take into consideration the duration of the disease.

4. A high polynucleosis in the face of severe lesions is of good omen and to be expected; it is its absence which gives cause for alarm. A favorable termination has been observed when the polynuclears were as high as 97 per cent.

5. An increasing polynuclear count is indicative of extension or increased absorption from the existing focus. It should negative delay in operative interference. It may be the only sign of extending infection or increasing absorption, or both, and may be independent of increase in rigidity and pulse-rate, etc.

6. A decreasing polynuclear count, on the other hand, may indicate the same as the diminution in an absolute increase, namely, subsi-

dence of inflammation, or arrest of one of the final forces at hand to combat the process. The facies and general condition of the patient will indicate the true state of affairs.

Another hint in elucidating the subject is of incalculable value, and we have not exhausted the means at hand until we have shown the relation of the differential count to the numeric count, a procedure which combines the advantages of both.

THE STANDARD CHART

To shed light upon a dark subject, Dr. C. L. Gibson (19) has devised the following scheme. (The accompanying diagram is self-explanatory; 10,000 leucocytes and 75 per cent polynuclears represent the standard horizontal base line; lines are drawn upon the chart to show a horizontal and a rising line.)

SERIES III

Diffuse Septic Peritonitis	Spreading Peritonitis	Localized Abscess	Without Pus				Total	Line	
			Gangrenous Appendix	Acutely Inflamed	Subacutely Inflamed	Chronically Inflamed			
4	7	15	1	5	0	5	37	Sl.	59.7% Rise
14	16	33	8	18	5	0	100	Mod.	
7	7	6	4	5	0	0	29	Steep	
7	2	13	0	7	3	11	43	Sl.	39.5% Fall
6	7	21	2	2	4	3	39	Mod.	
6	8	6	0	0	0	8	28	Steep	
0	0	1	0	1	0	0	2	Hoiz. 0.7%	
38	47	95	15	38	12	33	278	Total 99.9%	

This scheme has been applied to the cases in question and they are to be seen arranged in tabulated form in series III. By way of explanation, a disproportion of 0.20 to 3 cm. has been termed "Slight"; of 3 to 10, "Moderate"; above 10, "Marked disproportion" or "Steep" rise. Dr. Gibson writes: "Speaking very generally and with considerable reserve, the writer already attaches considerable significance to the findings which some of these charts have shown. 1. If the line connecting the levels of the leucocyte count runs pretty nearly horizontal whether up or down, only 2 to 4 units difference, it indicates a lesion that, whether severe or not, is well borne and therefore of good prognosis. 2. Lines running upward from the leucocyte side toward the polynuclear indicate in general a rather severe lesion and less resistance. 3. If the interval between the two points is considerable, we are pretty sure to have a severe lesion. 4. About two-thirds of cases of all kinds (surgical conditions) show a rising line, and we shall see later, in such conditions as appendicitis, all fatal cases have a rising line."

Dr. Gibson's findings in 25 cases of acute appendicular lesions are:

1. In 20 a distinct disproportion indicated by a rising line.

2. In 2 cases the line was nearly horizontal, showing a good balance between the two elements.

3. In 3 cases there was a distinct downward tendency of the line, showing preponderance of leucocytes.

4. All severe lesions, those with gangrene of the organ or progressive peritonitis, and all the fatal cases showed a rising line; while the cases indicated by a falling line were distinctly mild types, such as well-defined "safe" abscess with little febrile or constitutional disturbances.

5. As it is in the severer cases, particularly those in which the initial symptoms are obscure or perplexing, that we can least afford to make mistakes the great value of the polynuclear increase is evident, as the findings in these cases will hardly ever lead us astray.

6. The importance of a disproportionate increase in the polynuclears (rising line), particularly if progressive, cannot be overrated and those willfully disregarding such evidence are perhaps not exhausting all resources of diagnosis.

The 10 cases of chronic appendicitis cited by the originator of the chart showed on the whole little leucocytosis and practically no disproportion; 5 showed a falling line, and 5 a horizontal stationary line, or an insignificant rise.

In my entire series of 278 cases, a rising line was seen to occur in over 59 per cent, a falling line in the remainder, except in 2 cases in which a horizontal line obtained. Of the rises 37 were insignificant (less than 3 degrees), of the falls 43 were less than 3 points. The others were a 3 point to 10 or over rise and fall.

Diffuse septic peritonitis. A rising line occurred in 65.7 per cent of these cases. These include counts taken during the early and late stages of the disease. All those taken early show a marked disproportion, those late less as body resistance toward infection is affected.

Spreading peritonitis shows 63.7 per cent rises.

Localized abscess. A rise was encountered in 56.8 per cent of these lesions. There was one horizontal line, the remaining falling.

Gangrenous shows 86.6 per cent rising lines.

Acutely inflamed shows 71 per cent of rises.

Subacute 5 out of 12 were rising, moderate in each case.

Chronic gave 11 rises, 5 were insignificant, 6 moderate. The other 22 represented falls. The vast majority (all interval cases) of these last two lesions showed no absolute or relative leucocytes and hence are below the standard horizontal line.

REVIEW OF THE LITERATURE

The only observer to apply the Gibson chart to a series of cases, in so far as I am able to ascertain, is Noehren (18). He studied 52 cases in this way and observed 23 rising, 23 falling, and 6 horizontal lines. Six of his 14 cases of peritonitis (diffuse and spreading) showed either a horizontal or a falling line.

PERSONAL CONCLUSIONS

Of the three methods of investigation the last seems to the writer to offer the most advantages.

1. The numeric count tells us little of the degree of infection and extent of the inflammation.

2. The differential count alone tells us nothing definite as to how the patient is withstanding the lesion, and hence we cannot prognosticate so accurately.

3. The relation of the one to the other combines the advantages of both. It is true this method has its pitfalls; anexample is a case of diffuse septic peritonitis, leucocytes 10,000, differential count polynuclears 77, the low numeric count and differential give us but little information per se and a rising line showing a disproportion of but two points, but when we consider that a three day's illness had lowered the individual's resistance, an explanation is evident to account for the condition of the blood. Therefore, it is urged to take into consideration the duration of the disease before drawing conclusions, for ability to withstand infection has direct bearing upon this fact.

In such cases if we resort to the history, we see why we fail to get a distinct rise and we will not defer operation on that account.

4. A slight disproportion or a horizontal line does not necessarily mean a case in which we can defer mechanical intervention; before making a final decision all the available facts should be well balanced.

5. Before resistance is entirely undermined, namely, when the first barrier is affected (as shown by a low numeric count and a high polynuclear count), a steep rise is a safe guide for exploration. Cases intermediate between these two must be rated according as they approach the one or the other extreme.

The writer in closing wishes to acknowledge the courtesy of Dr. F. C. Wood, the attending pathologist to the hospital, and of the attending surgeons, Dr. Robert Abbe, Dr. B. F. Curtis, and Dr. C. L. Gibson who have kindly given me permission to use the blood examinations in their respective services.

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A RÉSUMÉ OF THE SURGICAL TREATMENT OF ANO-RECTAL IMPERFORATION IN THE NEW-BORN

WITH THE REPORT OF PERSONAL CASES

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THE history of the early surgical treatment of congenital absence of the rectum and anus, beginning in the dark ages of medicine and extending over the lapse of centuries to within a few generations ago, does not contribute a brilliant page to chirurgical art. What is practically the second period, however, dates from comparatively modern times, and being in a large measure the outgrowth of antiseptic and aseptic wound treatment, has kept even pace with the wonderful and rapid evolutionary changes which have characterized the recent progress in general operative surgery.

By the ancients this deformity was scarcely considered as amenable to the surgeon's skill, if we interpret aright the teachings of the Arabic and early Greek and Roman physicians, and the first authentic mention of such surgical intervention of which we possess any knowledge is the classical case recorded by Paulus Aegineta[1], in about the seventh century, who successfully operated upon an atresic anus in a new-born infant by perineal incision and dilatation. This operation, however, was little more than a blind plunge of the knife into the rectal pouch, but, nevertheless, the method grew in popularity, and as performed either with the bistoury or the trocar, or a combination of incision and puncture, followed by prolonged mechanical dilatation, was the procedure in vogue for hundreds of years. Hence we find the noted German surgeon, Laurence Heister, in 1768, and Benjamin Bell, of England, in 1787, advocating the method with but slight modifications, and yet again having the sanction of Copeland Hutchinson, in 1822. In France the operation received renewed impetus through the publication of a number of successful cases by Breschat in 1834, which was further accentuated by the report of Roux de Brignolles the next year. The latter operator improved the operation somewhat by advising that the fibers of the anal sphincter be carefully preserved during the perineal dissection. Then came Berard, in 1844, Vidal de Cassis, Guillon, Malgaigne, and Velpeau in the same country, together with Dieffienbach, who also advised resorting to colotomy if the perineal incision failed to open the rectal culde-sac. About the same period (1800), Dr. John P. Campbell, of Flemmingsburg, Kentucky, was the first surgeon in our own country to put the operation into successful practice.

The technique thus performed varied only in the depth, length, and direction of the perineal incision; and the first really important surgical advance was made by Amussat, in 1835, when he recommended and employed a rational perineal operation or true proctoplasty. This surgeon formulated the rules that a careful dissection of the perineum, extensive if neces-

[1] According to some writers, Paulus Aegineta flourished in the third century. His *De Re Medica*, in seven books, appeared in Paris, in 1532.

sary, be made to expose the rectal ampulla, which should be freely detached from the surrounding tissues, and, after evacuation of its contents, drawn down to the perineal incision, and the mucosa accurately sutured to the skin margin without undue tension. The all-important feature of Amussat's operation was the union of the mucous membrane of the enteron with the skin, and by this means preventing the contraction of the opening which, in the previous methods, always narrowed into a simple fœcal fistula, necessitating constant dilatation to permit discharge of the contents of the bowel. In those cases where the terminal end of the rectum can be easily reached through the perineum, this method, with but trivial changes, is still the one generally employed to-day.

Amussat practised in his early operations a T-shaped cut, the central or upright limb of which extended from the center of the anal area posteriorly to the coccyx, and the transverse bar passing across the perineum from one tuber ischium to the other. But anatomical objections resulted in his rejecting this incision and adopting the simple straight section extending along the mid-line of the perineum from the perineoscrotal juncture in the male, or the vulvar commissure in the female, to the coccyx.

Some years later, 1844, Stromeyer suggested that, in those instances where a perineal dissection failed to disclose the enteron, the peritoneum be deliberately opened through the perineal wound, the cavity explored by the finger, and the existence and location of the rectum accurately determined. This was a step in advance of his time, but it was never put to practical use until 1872, when Lieserink for the first time utilized the suggestion with a happy result. Since then, the operation has been performed by a number of operators.

Meeting with difficulties in reaching the rectum through an insufficient perineal wound in those cases where the viscus was situated high up in the pelvis, Amussat further advised securing the requisite space by prolonging the sagittal incision posteriorly and removing the coccyx in whole or in part, which he first employed near the end of the year 1835. This operation passed out of the general professional memory, however, until it was recalled by Verneuil in 1873, and, as a consequence, it has been erroneously ascribed by many authors, more especially French writers, to the latter surgeon.

In 1874, Delens was able to get the necessary room by dislocating the os coccygis backward instead of extirpating it. And Polaillon, in 1875, recorded a successful case in which he divided the soft semi-cartilaginous bone through the middle (median coccygotomy), and by forcing the two halves asunder, gained the required space for deeper dissection. The first coccygectomy for rectal imperforation, performed in America, was done by Byrd, of Quincy, Illinois.

Finding that in not a few instances resection of the coccyx still failed to furnish an adequate field for manipulation, Vincent, of Lyons, availed himself of Kraske's idea of resecting the sacrum in rectal carcinoma, and, in 1887, applied the sacral route to two cases of congenital absence of the rectum by dividing the bone in the median line. But shortly thereafter, he discarded the operation of median coccygosacrotomy for his parasacral incision, through which he maintained that the anomalous rectum could be readily reached and brought to the surface. The parasacral incision commences in the perineum at the posterior edge of the proctodeum, if this is present, and passes in a straight direction backward to the point of the coccyx, then deviates to the left, to follow closely the border of the sacrum, and extending up to the level of the top of the sacrosciatic notch.

Several modifications of Vincent's sacral method soon followed, such as a median division of the sacrum with bilateral osteoplastic flaps, employed by Hienecke, in 1888, followed with slight changes by Kocher, Morestin, Jeannel, Borellius, and others; and the single osteoplastic sacrococcygeal flap by Roux, in 1889, Rydygier, and so on. In the next ten years other modifications, more or less important, were introduced by a number of operators, of whom may be mentioned Ceci, Burrell, Chaput, Czerny, Matas, White, Elliot, and Keen. It must be recognized, however, that sacrificing, by permanent removal, any portion of the sacrum naturally lessens the strength and sup-

port of the pelvic floor, besides injuring important muscular attachments and jeopardizing both nerve and vascular supply. These considerations are strongly emphasized by Matas in his exhaustive monograph read at the meeting of the American Surgical Association, in 1897, in which he shows that in the majority of instances, the rectal infundibulum can be located and drawn down through either the simple parasacral incision of Vincent, or some one of the forms of osteoplastic resection of the sacrum, decided preference being given, of course, to the sagittal division of the bone for the obvious reasons just stated. Again, in all cases, it should be remembered that the sacrum should not be divided higher than the lower border of the third sacral foramen, since above this point there is danger of penetrating the sacral canal.

As early as 1710, Littrè proposed the formation of an artificial anus in the iliac region for obstructive disease of the colon and rectum, but the suggestion does not seem to have been applied to the living subject until over a half century later, when Pillore opened the abdomen in the right iliac space and attached the cœcum to the parietal wound, for cancer of rectum (cœcostomy). However, left iliac colostomy for the relief of congenital imperforation of the rectum was performed for the first time by Duboise in 1783, and this case was speedily followed by those of Dinet and Desault. All of these cases terminated fatally but the procedure continued to be rather gen erally adopted by operators, and, although the mortality remained high, there were a few cases reported where the children thrived and lived for years, and in one or two instances even advanced adult life was attained.

At the present time, inguinal colostomy with a permanent artificial anus should, as a rule, be regarded as a final operation only in extreme conditions of malformation where the rectum is totally absent, or situated so high in the pelvis as to render it impossible to bring it down to the surface by the most extensive perineal and sacral dissection.

Lumbar colostomy, after either the methods of Amussat, or Bryant, is practically obsolete, and does not come within the modern discussion of the subject.

In certain instances where the surgeon fails to recognize the colon and rectum, and the condition of the child is so precarious as to preclude the risk of further search, an enterostomy (Nélaton), by utilizing the first prominent loop of intestine that presents in the wound, should be employed, and has been resorted to successfully. This measure is applicable alike to the abdominal and sacral operations.

Neil McLeod was the first to suggest, in 1880, combining abdominal exploration with perineal section. He advised, after failure to find the enteron through the perineum, that the abdomen be opened in the median line and the position of the gut determined; then with the finger in the abdomen as a guide, deepen the perineal incision through into the peritoneal cavity, seize and drag down the rectum and fasten it in the perineum. The abdominal wound was then closed.

This operation was modified by Paul Delageniere, in 1894, in that he reversed the stages of the procedure, that is, performing an initial or primary lateral cœliotomy, locating the rectal cul-de-sac, and then opening the perineum through into the pelvic cavity, guided by the finger within, and pulling down the blind rectum to the surface with the establishment of a perineal anus.

This combination of abdominal exploration and perineal anal restoration has little to attract the surgeon of to-day, and, for apparent and practical reasons, can scarcely be viewed as a rational surgical measure.

The idea of utilizing the colostomy opening for the introduction of a guide along the lumen of the bowel in attempting to restore the anus in its normal position in the perineum, seems to have originated with the younger Martin, of Lyons, in 1798. But this was never applied in practice until 1856, when Chassaignac took up the suggestion and crystallized it into a definite surgical procedure. He advised that a preliminary iliac anus be made, and then, as a *secondary measure*, at some later period, a sound or probe should be passed and the terminus of the colon pushed down against the perineum, and the perineal body incised upon the impinging tip. The artificial anus in the groin was then to be closed permanently.

He operated upon an infant seven months after a preliminary iliac colostomy, and succeeded in establishing a perineal fœcal outlet. The operative recovery was satisfactory.

Krönlein, in 1879, was the next operator of which there is a record to perform this operation. But, inasmuch as he fastened a loop of small intestine, instead of the colon, in the iliac incision, he did not make a typical colostomy. Consequently, the second case in chronological order should be accredited to Haynes, who, in 1883, twenty-three days after a Littrè colostomy, successfully established a perineal anus. But the child died from convulsions several weeks later before the opening in the groin could be closed.

Lannelongue's case then followed, in 1884. He performed first an iliac colostomy, and, after the expiration of twenty days, succeeded in forcing down the colonic sac and making a perineal outlet, with operative recovery.

Demelin's case, operated on in 1895, comes next. He did not follow the steps of the procedure in a typical manner, although possibly it should be included in this group. He made first a median perineal section, then resected the coccyx, but failed to locate the rectum, and finally was forced to perform inguinal colostomy. Several days later he attempted to guide the terminal pouch down to the perineum, but the distance proved to be too great, further manipulation was abandoned, and the groin anus left undisturbed. The child recovered.

During the same year Drs. Stuart and Bierwith operated on an infant in which all the steps of the operation were consistently carried out. This case was reported in 1897. A preliminary colostomy was performed on the second day after birth. The proctodeum was well formed and the anal thimble extended up about one inch and a quarter. After a period of five months, under chloroform anæsthesia, perineal communication was restored by pushing down the rectal ampulla with the aid of a gum-elastic bougie inserted through the colostomy opening, and drawn out through an incision made in the anal cul-de sac, to which it was finally sutured. At the expiration of two weeks, the colostomy opening was successfully closed, but the perineal anus evinced a tendency to contract. The operative recovery was complete, although the child died, when fourteen months old, of marasmus and furunculosis.

Dr. A. E. Maylard, in 1896, operated on a child eleven days old. Its condition was most critical, and failing to discover the rectum by puncture with a tenetome at the apex of the well-formed anal pouch, he resorted to an iliac opening. Ten weeks later, with a bougie as a guide, pressing down the colon, he incised the perineum and succeeded in carrying a rubber tube through the perineal wound to the sigmoid anus. The child recovered, but contraction and stricture followed, and it succumbed to an attack of scarlatina, four and a half months later.

All of these seven cases recovered, but died at later periods from causes probably extraneous to the operation, thus furnishing one-hundred per cent of immediate or operative recoveries.

Just here it should be observed that Sir William MacCormac, in 1886, quite independently of the work of other surgeons, advised that in those cases where the bowel ends at an unknown distance from the perineum, immediate relief should be secured by a Littrè colostomy. And again, what is of essential importance, that this should be regarded as the operation of election in feeble and exhausted children, since it enables the child to recuperate and become stronger for the ordeal of the later, possibly severe, work in the perineum that would be demanded. The case he reported died, however, from peritonitis and rectal ulceration, before the formation of a permanent perineal anus could be accomplished.

In summing up the advantages and disadvantages of preliminary colostomy in these cases, Matas, in his admirable article already referred to (and to which I am indebted for much of the historical data concerning this subject), says the advantages may be stated to be: 1. The urgent symptoms are promptly relieved by the discharge of meconium, and a reasonable delay then enables the infant to recover and strengthen for the coming shock of a later complete perineal operation; 2. The rectal ampulla may descend spontaneously and be found at a point more readily accessible than at the time of birth. Whereas the possible disad-

vantages may be enumerated as: 1. Puncture of the rectal ampulla by injudicious employment of the guide; 2. The preliminary anchoring of the colon may limit its subsequent mobility, or rather descensus; 3. If the formation of the final perineal outlet is postponed for any length of time, fœcal stasis may produce ulceration in the terminal end of the colon, resulting in peritonitis and death; 4. and, Finally, that operations of a dangerous character may be necessary for the closure of the groin anus.

Whilst these objections to preliminary colostomy obtain, undoubtedly, in some instances, it seems that they might be narrowed down essentially to two, namely, the curtailment of the mobility of the colon, and the danger of fœcal stasis and ulcerous rectitis with peritonitis.

The operation of perineal proctoplasty immediately following the formation of the colostomy, has not the same arguments in its favor as when undertaken as a secondary or later measure. The reasons therefor should appear ample to the mind of the judicious surgeon, notwithstanding that the several cases on record in which it was resorted to show operative recovery practically in all.

In 1880, Owen reported two cases; Stephen Paget one case, also, in 1880; and Chaput one case, in 1892. These case perished at periods varying from a few days to several months, although in none of them could it be said that the fatal issue was due directly to the operation.

The general results after any of the operative methods, or combination of methods, for the relief of imperforate rectum and anus cannot be regarded as encouraging, for even the improved modern statistics over the high mortality rate of preantiseptic days is yet far from having attained a satisfactory standard. This may be accounted for especially by the character and degree of the malformation, the tender age of the subject, by the frequent delay before surgical aid is invoked, and, in some measure, by the indecision as to what form of operation should be adopted.

The old operation of perineal puncture by trocar or knife, with its high operative mortality (Curling 76.4 per cent; Anders 50 per cent; Cripps 82.3 per cent), has long since passed from surgical consideration.

Simple perineal proctoplastic procedures in general give a death rate ranging form 30.5 to 61.9 per cent (Cripps, 32.7 per cent; Curling, 39.3 per cent; Ducuron, up to 1889, 61.9 per cent; Anders, 30.5 per cent). These figures were markedly reduced, however, by the later compilation of Anders (100 cases) in 1893, embracing the antiseptic period, which reduced the mortality to 28.44 per cent; and other more or less irregular perineal methods to 32.22 per cent. But it should be understood that Anders' statistics include largely a class of unimportant cases in which the rectal infundibulum was situated in close relationship to the perineum or even where the separation between the rectum and anus was only a thin, membranous septum. Again, in simple perineal proctoplasty, with the exclusion of those cases involving the vagina by a fistulous communication (atresiæ ani seu vaginalis), we find the mortality varying between 38.2 and 40.4 per cent (Anders 38.2 per cent; Cripps 40.4 per cent; Tuttle 39.3 per cent). More recently, A. P. C. Ashhurst has tabulated a series of 95 cases, of which 83 were collated from the literature since 1900, with a primary mortality lowered to 21.2 per cent, and still further reduced to 13.3 per cent, by excluding 10 fatal cases from the whole number. Here, also, as in Anders's later statistics, it must not be forgotten that this list comprises a certain proportion of exceedingly trivial cases, which necessarily serve to bring down the mortality to this low figure. Again, the last observer, in 12 cases of atresiæ ani seu vulvaris — a class admittedly of the most favorable type of the abnormality — found a mortality of 8.33 per cent. Moreover, it should be noted that, in from 40 to 50 per cent of all cases, the atresic rectum communicates by a fistulous tract with the vagina, or some other viscus.

In perineal incision with coccygectomy, the statistics of Matas (recorded cases from 1842 to 1897) give a primary mortality of 37.50, but which is reduced to 12.50, by excluding 4 cases not believed to have any direct bearing on the operative result.

Matas's collection of 14 cases of sacrococcygectomies gives an immediate, or operative, mortality of 21.42 per cent, but with a secondary, or actual, mortality of 64.27 per cent.

The mortality percentage of primary ab-

dominal colostomy (Littrè) varies from 43.7 to 68.4 per cent (Ducuron 62.6 per cent; Curling 47.6 per cent; Cripps 68.4 per cent; Anders (1893) 52.8 per cent; Ashhurst (since 1900) 64.3 per cent; and Tuttle (1903), 43.7 per cent).

Secondary colostomy, after attempted perineal proctoplasty, gives the large death rate of from 45.2 per cent (Tuttle) to 73.3 per cent primary, or 69.2 per cent improved mortality, as shown by Ashhurst. Furthermore, Ashhurst's tables show a mortality rate of 50 per cent in primary laparotomy combined with secondary proctoplasty.

The most cursory examination of these statistics indicates at once the lessened mortality in all perineal operations over the abdominal or transperintoneal procedures. But when it is considered that a large proportion of the perineal operations are of the simplest character, whereas the colostomy cases usually comprise the gravest type of the malformation, and the operation is resorted to only after probably a long and unsuccessful perineal dissection with a shocked and exhausted child, it can be readily appreciated that the statistical results are more apparent than real. Nevertheless, considering these results, together with the knowledge that the rectum is entirely absent or inaccessible through a perineosacral incision in only about 10 per cent of the cases, no surgeon of the present day would consider for a moment any other than the low route as the method of election, leaving the operation of inguinal colostomy to be applied in exceptional instances, or, at least, in weakened and septic infants where it is imperative to give exit to the pent-up meconium by the most expeditious and certain means. But, at the same time, I am not quite sure that inguinal colostomy may not have a somewhat broader field of application than merely as a *dernier ressort* in these cases, and it would appear that the present statistical data afford sufficient evidence in support of the assumption.

RECORD OF PERSONAL CASES

I have referred rather in detail to the cases of colostomy followed at once, or at a later period, by perineal proctoplasty, because this double operation has some bearing on one of my own cases (Case 1) where it was proposed to adopt both steps of the procedure, but which could be carried out only to the extent of making the primary iliac anus.

This case presents several features of importance, and its report is the *raison d'être* of this thesis.

Case 1. A white, male infant, 61 hours old, referred to me by Dr. V. P. Gaines, of this city, December 24, 1899. This was the second child; born after a natural labor; appeared healthy and normal; nursed vigorously when first applied to the breast; and voided urine freely, which was clear, leaving no stain on the linen. There was no bowel action, however, which was not reported by the nurse until the night of the second day. Then examination disclosed an imperforation of the rectum, and I was requested to see the child the following morning.

Examination now showed a restless child, crying and moaning, vomiting at intervals, jaundiced, abdomen decidedly tympanitic, rapid and feeble pulse, or, briefly stated, in a very critical condition — the picture of intestinal obstruction, peritonitis, and sepsis. The proctodeum was natural in appearance and readily admitted the little finger, but ended in a blind, narrow, cone-shaped sac, about an inch above the orifice. There was no impulse felt, either through the anal thimble or elsewhere in the perineum, when the child cried.

On account of the extreme conditon of the infant, it was decided to perform left inguinal colostomy, with secondary proctoplasty at the earliest favorable time, aided by a guide in the bowel. The operation was performed at once under chloroform anæsthesia, on an improvised box table, with poor sanitary surroundings. The abdomen was opened by an intermuscular incision. Flocculent serum gushed from the peritoneal cavity, and the distended sigmoid bulged into the wound. The gut was caught and pulled up from below until resistance was felt, and then attached to the edges of the incision by a double row of silk sutures. No attempt at spur formation was made, since the artificial anus was intended as a temporary measure. The intestine was opened by a free incision and large quantities of meconium evacuated. The exhausted condition of the child precluded further surgical measures, and even exploration of the colon was avoided. The child reacted quickly, the wound united per primam, and recovery was prompt and uneventful.

A few weeks later, when it was urged that the operation should be completed and a perineal anus made, the parents refused, on the ground that they were satisfied with the child's condition and development, and no argument could alter this determination.

The patient now passed from under observation until 1906, and was seen again last fall. At this latter date (September, 1907), when the accompanying photograph was taken, he was 7 years and 9 months old. I found him a normally developed, well-nourished, vigorous boy, though tall and slender, and was told that he was as

Case 1. Age 7 years and 9 months. Inguinal colostomy.

active as, and indulged in all the sports of, children of his age. He had escaped the usual diseases of childhood and passed through the teething process without bowel complication.

The groin anus admits the first joint of the index finger, there is no excoriation of the surrounding skin, and he has a certain control over the bowel movements — the only inconvenience in this respect being the embarrassment experienced by the occasional escape of flatus. The stools are usually semi-solid, and the protective pad is only soiled to any extent when these are loose. The unused proctodeum has developed in proportion to the growth of the child, admits the finger to the depth of one to one and a half inches and ends in a cone-shaped pouch, the apex of which is narrowed to the size of a pencil, and with a crescentic fold of mucous membrane stretching across one-half the diameter. A metal sound, introduced through the inguinal opening, readily passed both upward and across to the middle line into a large pouch, probably the dilated sigmoid, but cannot be carried downward in the natural course of the colon for more than an inch and a half. No manipulation was successful in approximating the end of the sound in the colon and the finger in the rectum — a wide interval existing between them. The outline of the pouch is easily recognized through the abdominal walls, when the child strains, and is seen to extend upward and across to the middle of the abdomen, but reaches, apparently, not more than an inch below the level of the anterior superior iliac spine in the downward direction.

The examination amply demonstrated that the inguinal anus was made directly into the bottom of the terminal pouch of the enteron, and that a wide interval, or gap, existed between this and the proctodeal or anal cul-de-sac.

The parents are still steadfast in their refusal to permit further surgical intervention.

It has been accepted as beyond question that the operation of perineal proctoplasty is the procedure of choice in imperforate rectum. Again, it has been amply demonstrated that the new-born child, although quite susceptible to sepsis, offers fully as much resistance to the shock of prolonged traumatism as the adult, (Bodenhamer, Giraldès, and others), and consequently, is able to bear the most extensive perineal and sacral dissection. Still, this case teaches, in conjunction with some other cases, that permanent colostomy is compatible with the growth, proper nutrition, and vigorous health of the child, and that it does not necessarily succumb within a few weeks or months to malnutrition and disease as has been frequently affirmed. It shows still more, that the inguinal colostomy can produce an anus of fair function, and that the child is not always relegated to a life of discomfort, misery, and shame.

The happy result in this case was due, in no small measure, to the fact that the opening in the bowel, fortunately, was at the bottom or terminus of the colonic pouch. This was clearly shown by the later examination when the sound was introduced into the gut. If the rectal cul-de-sac had reached lower down in the pelvis, the fœcal masses would have accumulated in the portion below the inguinal anus, and the case probably terminated in ulceration and peritonitis, as did MacCormac's patient.

Case 2. A vigorous male infant, white, fourth child, easy labor, 48 hours old, referred to me by Dr. E. L. Marechal, October 3, 1903.

The child is normal in every respect, except the anal deformity, and voids an abundance of clear urine. It began vomiting shortly after birth, and this continued at moderate intervals. It frets and strains a great deal, and gives evidence of pain and discomfort. The skin is jaundiced, the abdomen moderately distended, but the pulse and general condition fairly good. The perineal raphe is prominent and extends in an unbroken line back to the coccyx. There is no vestige of the proctodeal dimple, and palpation fails to reveal evidence of fluctuation, although when the child strains there is felt an indefined sensation of resistance. Chloroform anæsthesia. Median incision in perineum, extending from just behind the perineosacral angle

posteriorly to the tip of the coccyx, which was deepened to fully an inch when the enteron was reached, drawn down and sutured to the skin with chromic catgut, and then opened, with an abundant flow of meconium. The wound healed by primary union, and the case progressed without incident.

September 15, 1907. The child was seen to-day. He is now four years old, well-developed, and in vigorous health. The anus is normal in appearance, with the characteristic rugæ present, sphincter control is perfect, it is dilatable and easily admits the finger.

Case 3. A negro, male, child, three days old, brought to me, November, 1892, by the midwife on account of absence of the anus. The child's condition was poor, abdomen distended, weak pulse, vomiting a thin, mucoid fluid, and crying and straining. Kidneys active. The perineal raphe was distinct and led back to a slight depression in the skin at the normal anal site. In this area indistinct fluctuation was evident when the child cried, but there was no bulging.

No anæsthetic used. Median perineal proctoplasty performed. The rectal cul-de-sac was found at the depth of three-fourths of an inch, and easily drawn down and stitched with silk to the perineal incision. Healing was prompt, and the child recovered without incident. The child was seen three months later, and was then well and strong, with a naturally functionating anus.

Case 4. A premature (7 months) white, male infant, three days old, seen September 5, 1895. Condition that of collapse, vomiting, moaning, pulse scarcely discernible, skin icteroid, tympanitic abdomen, urine clear. The perineal raphe was quite prominent, but no semblance of an anus — the perineum being perfectly smooth. There was no fluctuation or impulse perceptible. The child was otherwise normally formed. Operation suggested, but rejected by parents. Death took place a few hours later.

These other cases offer no special interest, beyond strengthening our knowledge of the fact that the enteron is usually situated in near proximity to the perineum, and, consequently, the large majority of cases of ano-rectal imperforation are comparatively trivial in character, and can be relieved often by the simplest form of perineal proctoplasty.

THE PARADOX POSITION OF THE PELVIS IN SCOLIOSIS

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IN the explanation of the mechanical condition of the lateral curvature of the spine the authors consider the spine a bar supporting the weight of the body which is fixed below by the pelvis. There is a space for lateral deviation of the spine, reaching from the cervical to the lumbar part of the latter. The pelvis, with the sacrum inserted in it, maintains a neutral position by virtue of the fact that the direction of the transverse pelvis axis, as a rule, is a horizontal one in ordinary scoliosis.

In the normal spine as well as in the scoliotic one mostly exists a constant relation between spine and pelvic position, inasmuch as the longitudinal axis of the lumbar part of the spine is cutting in a right angle a plane drawn through the upper surface of the sacrum and the pelvis, this fact being in perfect accord with the comparison of the fixed bar already referred to. Now, whenever an oblique position of the pelvis exists, due to static conditions (unequal

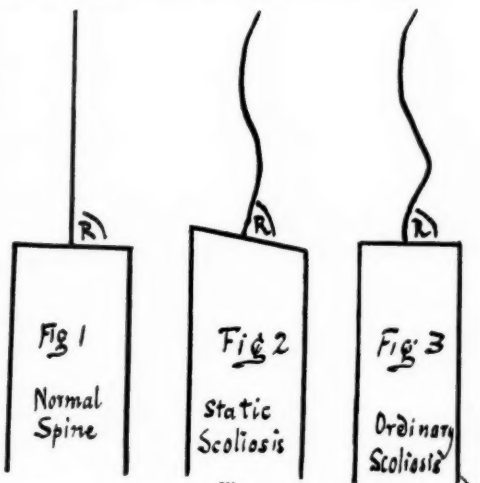

Fig. 1.

length of the legs) this standing relation between lumbar spine and pelvis mentioned above

Fig. 2. Marie K.

has to appear in a lateral turn of the former, the convexity being directed toward the side of the lowered half of the pelvis. Even in this case the angle formed by the spine and the transverse axis of the pelvis, will constantly be a right one (see Fig. 1).

I herewith call attention to a series of cases, comparatively rare, in which there exists a disturbance of that standing relation. These cases thus stand in contrast to the normal spine and the vast majority of cases of scoliosis. Altogether, I had 7 cases under observation, 5 of which belong to hospital material, and 2 to the private practice of my former chief, Dr. von Friedlænder.

Case 1. Miss D., 17 yrs. old, examined June 18, 1902. In early childhood patient wore a brace on the left leg. For several years an inequality of the hips is noticed. When standing upright the spine shows the normal curvature in the sagittal plane. Right hip triangle (the space included in the inner surface of the arm and the line from the axilla to the thigh) is deeper; right hip projects and drops 1.5 cm. The spinous processes deviate to the left in the lumbar, to the right in dorsal part of the spine. Both scapulæ are symmetrical. When bending forward there is neither a lumbar nor a costal prominence. Sitting on oblique seat, allowing the right half of the pelvis to drop, causes the lumbar

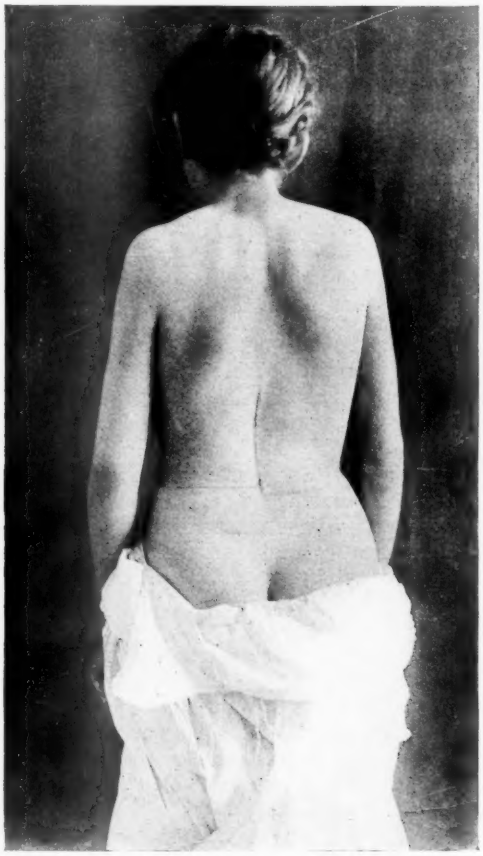

Fig. 3. Josephine S.

scoliosis to disappear. Both legs are muscular and strong. The right leg shows a shortening of about ⅛ of an inch. When compensating this difference by raising the right heel, the lumbar scoliosis is increased, which, however, disappears by raising the left heel.

In this case there exists thus, a right dorsal, left lumbar scoliosis, first degree, as well as a static dropping of the right pelvis due to the shortening of the right leg. Compensation of the dropped pelvis does not cause a compensation, but on the contrary an increase, of the scoliosis.

CASE 2. Mary S., 10 yrs. old, examined March 16, 1904. Since summer 1903, off and on, walking is impaired. Examination shows slight left lateral deviation of the lumbar spine without torsion; evident lateral deviation to the right of the upper dorsal spine, distinct costal prominence and elevation of the right scapula. Right hip is dropped for 1.5 cm. by shortening of the right leg. Examination November 30, 1904: Essentially the same clinical picture. Whole trunk displaced to the left. Left hip triangle opening downward. Distinct right dorsal, slight left lumbar scoliosis, the right spine anterior and posterior are situated 1.5 cm. deeper than the left. Shortening of the right leg amounts to 1.5 cm.

By raising the heel of the shortened leg, the displacement of the trunk and the scoliotic deviation to the left are increased; by raising the heel of the longer leg, however, for 1.5 cm. the deviation of the lumbar spine disappears, while the oblique position of the pelvis at the same time is increased.

Right dorsal, left lumbar habitual scoliosis, second degree; besides static dropping of the right pelvis due to shortening of the right leg for 1.5 cm. Compensation of the static difference causes increasing of the scoliosis, increasing of the static difference (by raising the left heel) causes compensation of the habitual scoliosis.

CASE 3. Regina F., 12 yrs. old. Examined Nov. 22, 1904. When lying on the back slight displacement of the trunk to the left. The right spina anterior superior stands 1.5 cm. deeper than the left; shortening of the right leg for 1.5 cm., slight atrophy of the right leg. In the upright position a remarkable displacement of the trunk to the left is observed, the right hip triangle being deeper, there is no difference in the outlines of the shoulder. Also in standing the right spina anterior superior appears 1.5 cm. deeper than the left. When bending forward the left loin projects; there is also a right costal prominence extending from the 3rd to the 8th rib. By extension the lateral deviation of the spine can be compensated entirely, while the lumbar and dorsal prominence still persist. Heightening of the right heel for 1.5 cm. does not influence the scoliosis. Right dorsal, left lumbar habitual scoliosis, 2nd degree; beside static dropping of the right pelvis by shortening of the right leg. Compensation of the static difference without influence upon the scoliosis.

CASE 4. Mary K., 8¾ yrs. old. Examination January 8, 1906. Left total scoliosis, slight degree. Right hip triangle somewhat deeper than the left; left shoulder and scapula higher than right. The spine is perfectly movable. The right spina anterior superior is situated 2 cm. deeper than the left, the right leg being shortened 2 cm. Raising of the shortened leg without essential influence upon the scoliosis.

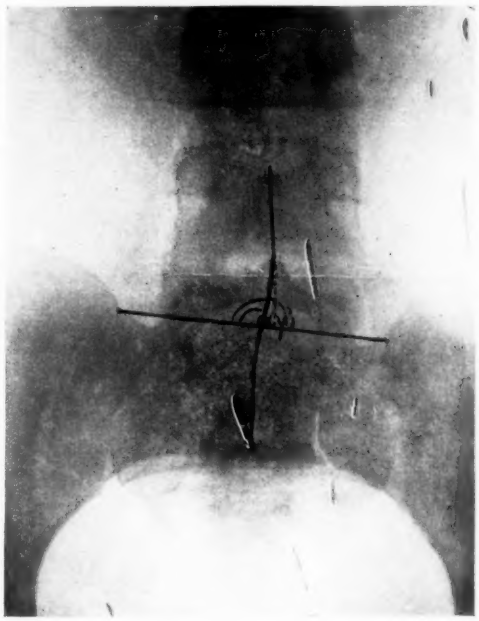

Fig. 4. Marie K.

The X-ray picture shows the vertical axis of the last lumbar vertebra resting on the os sacrum obliquely to the left. There is an angular deviation between the lumbar spine and the longitudinal axis of the os sacrum.

Left habitual total scoliosis first degree, in addition static dropping of the right pelvis due to shortening of the right leg. Compensation of the static difference does not interfere with the scoliosis.

CASE 5. Miss Josephine S., 16 yrs. old. Examined March, 1906. Well-developed right dorsal scoliosis (Fig. 3), left lumbar curvature, a lumbar prominence being slightly visible. Right hip triangle somewhat deeper. In spite of the left lumbar curvature, the right right spina anterior superior stands deeper than the left for 1.5 cm. Compensation of the shortening of the right leg causes a remarkable increase of the lumbar curvature; the latter disappears, however, by raising the heel of the left leg. X-ray picture (Fig. 4). Longitudinal axis of the lumbar spine inclined to the left side; angular deviation between lumbar spine and sacrum.

Right dorsal, left lumbar habitual scoliosis; in addition static dropping of the right pelvis due to the shortening of the right leg. Compensation of the static difference increases the habitual scoliosis, and vice versa

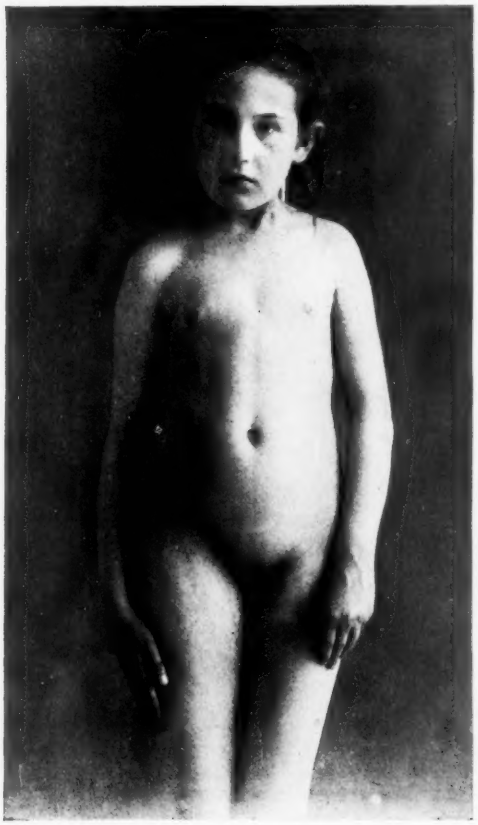

Fig. 5. Gertie P.

Case 6. Miss Mary W., 14 yrs. old. Examined March, 1906. Musculature well developed. Besides a slight right dorsal scoliosis, a distinct left lumbar curvature exists. Right spina anterior superior lowered 1.5 cm. corresponding to the difference of the length of the legs. Lifting of the right heel causes no alteration of the scoliosis; raising of the left heel, on the contrary, causes a nearly complete compensation of the lumbar scoliosis.

Left side habitual lumbar scoliosis; in addition static sinking of the right pelvis by shortening of the right leg. Compensation of the static difference without noticeable influence upon the scoliosis; increase of the former diminishes the habitual scoliosis.

Case 7. Gertie P., 12½ yrs. old. Examined August, 1906. Admitted to the hospital for operative treatment of torticollis. At birth the existing transverse position was corrected by obstetrical interference. By doing this two injuries were afflicted. A fracture of the right femur and an extreme traction upon the left arm and the left side of the neck. The inclination of the head toward the left was noticed only since the child was six years of age and is reported to have increased lately. Well developed. The head by contracture of the left musculus sternocleidomastoideus inclined to the left and twisted to the right side. The left sternocleidomastoid muscle projects, both insertions being distinctly palpable. The antagonistic movements of the head are correspondingly limited. There is a slight degree of right facial scoliosis (Fig. 5). Right dorsal cervical scoliosis due to the caput obstipum with left dorso-lumbar secondary curvature (Fig. 6). In spite of the latter, there is a lowering of the right spina anterior superior for 1.5 cm. Slight paresis of the left upper extremity.

Heightening of the heel of the right leg causes an increase, of the left leg, a decrease of the left lumbar scoliosis.

In this case a right dorsocervical scoliosis due to the contracture of the left sternocleidomastoid muscle accom-

Fig. 6. Gertie P.

panied by left dorso-lumbar secondary curvature exists. In addition static lowering of the right pelvis due to the shortening of the right leg. The compensation of the static difference causes an increase of the lumbar scoliosis; the increase of the static difference causes a compensation of the lumbar scoliosis.

A review of these cases at first shows a remarkable harmony in the clinical features. In all cases there exists a static lowering of the right side of the pelvis, caused by a shortening of the right leg. With exception of the last case, in which there existed a fracture of the femur, trauma could not be assigned as a cause of the shortening of the extremity. Now, the question is, what are the relation between those cases of scoliosis and the static alterations of the pelvic position, that is, whether there is any causal connection between both symptoms.

It is evident from the whole feature, that there are no cases of merely static scoliosis under discussion. The most remarkable points, however, are the relation between lumbar spine and position of the pelvis, the oblique direction of the spine to the upper surface of the sacrum, the convexity of the curvature on the side of the raised half of the pelvis, this fact being perfectly contradictory to the static presuppositions. (Fig. 6.)

After all, we have to consider these scolioses as being occasioned by a secondary cause, in patients where a static different position of the pelvis due to inequality of the legs exists, the latter being caused simultaneously or previously with reference to the habitual scoliosis. As the static scoliosis very seldom, if at all, is fixed, the entirely mobile spine does not present the least obstacle to the action of any forces which are liable to produce a habitual scoliosis deformity.

Accordingly we find in cases 1—6 habitual scoliosis; right dorsal, left lumbar in cases 1, 2, 3, 5; left total in case 4; left lumbar in case 6. Case 7 shows a dorsocervical scoliosis due to the caput obstipum with left lumbodorsal secondary curvature. Thus, these cases present lateral deviations of the lumbar spine to the left according to the action of a mentioned secondary and independently scoliotising cause which so evidently is contradictory to the presupposition of the position of the pelvis. Most evidently this secondary cause appears in case 7. The child acquired during birth both a rupture of the left sternocleidomastoid muscle and a fracture of the right femur; thus two injuries which are both liable to lead to secondary scoliotic deformities of the spine. The left caput obstipum is supposed to produce a primary right dorsocervical and a secondary left lumbar curvature, while the shortening of the right leg is supposed to produce a static lowering of the right pelvis followed by right lumbar curvature. When examining the child at 12 years we ascertain the caput obstipum, with the facial scoliosis, the right dorsocervical and the left lumbar scoliosis. We also ascertain the shortening of the right leg as leading to the lowering of the right pelvis.

But we do not ascertain the right lumbar scoliosis, which we might expect as a consequence of the pelvic position, because the action of the caput obstipum in as far as it produces a secondary scoliosis is superior to and overcomes the contrary action of the static presuppositions, which hardly ever produce a fixation of the spine.

The paradoxity existing between the scoliotic spine and the position of the pelvis, being caused by the interference of two actions, both intending to produce scoliosis and opposite to each other, is characteristic for this group of cases. This paradoxity is clinically expressed by the lateral turn of the lumbar spine to the side of the lifted pelvis. In the X-ray picture it is designated by the angular deformity between the axis of the lumbar spine and the os sacrum.

As to the frequency of these cases of paradox pelvic position, I hardly can make a close statement at this time. At any rate, the disease is not so very rare. Among 43 children of the ambulant scoliotic material of 1906, I found three positive cases. In the literature I could not find any statements concerning the paradoxity in this meaning. The parodoxity of the authors from Kirmisson to the recent literature concerns the relation existing between curvature and torsion of the ribs.

I not only owe to the kindness of my former chief, Dr. Friedlænder in Vienna, the privilege of having the clinical material for this paper at my disposal, but I also thankfully have to remember his most valuable aid in my studies.

PRIMARY SARCOMA OF THE LIVER

By VAN BUREN KNOTT, M. D., Sioux City, Iowa

THE history of the word "sarcoma" is very obscure. For many years growths of the most varied anatomical characteristics were all classified as "fleshy tumors." Celsus, under the names myrmecia and steatoma describes growths bearing the clinical characteristics of the sarcomata. Under the name steatoma, Galen described various bulky polypi.

Confusion in nomenclature, with no very serious effort at its correction, prevailed for many years until, early in the 18th century, we find surgeons attempting a classification of tumors — Saviard in 1702, Heister in 1750, and Boerhave in 1751 described fibrous tumors of the uterus and osteosarcomata as sarcomata, but made no definite distinction between a sarcoma and a steatoma. Other efforts at classification were made by other surgeons during the later years of the century, but it remained for John Abernathy, in 1809, to introduce the generic term sarcoma in the classification of tumors.

To-day we recognize as a sarcoma a malignant tumor belonging to the connective tissue group and consisting either of pure embryonic tissue or of embryonic tissue undergoing its first modifications in becoming adult tissue.

While a discussion of the general characteristics of sarcomata would be of interest, it cannot be undertaken at this time and no effort will be made to consider this phase of the subject, except as it bears directly upon sarcoma of the liver.

Primary sarcoma of the liver is a rare disease, and an exhaustive search of the literature reveals but few cases as compared to carcinoma and other neoplasms affecting this viscus. In fact, the scarcity of literature upon this subject is most marked and has rendered the search for data, which might be of profit and interest in this connection, most tedious and difficult.

Few of the modern text-books mention the subject at all and when mentioned it is usually to state that it is very infrequently observed. Rolleston, in his work upon "Diseases of the Liver" presents many interesting facts bearing upon this disorder, and I wish to acknowledge the great assistance rendered thereby in the preparation of this article.

In 1901, Vecchi and Guerrini, after a critical examination of the forty-five cases reported as primary sarcoma of the liver, accepted only twenty-one cases as undoubted examples of this condition. Rolleston states that he has notes of sixty-four cases of "reputed" primary sarcoma of the liver but fails to state how many of these he considers as authentic.

I have been able to collect from the literature fifty-nine cases of this disease to which I wish to add fourteen reported in personal letters received in response to letters of inquiry sent to thirty of the leading surgeons of the United States, and one of my own, making a total to date of seventy-four cases of undoubted cases of primary sarcoma of the liver.

It is only proper to state at this time that many cases reported as primary sarcoma have been rejected and that some few cases reported as carcinoma many years ago, when the line of demarcation between carcinoma and sarcoma was not very sharply drawn, but which careful analysis proves beyond a doubt to have been sarcomata, have been included in this list.

SEX

Primary sarcoma of the liver seems to occur somewhat more frequently in males than in females, as in the seventy-four cases above mentioned twenty-nine were males, twenty-one females, and in twenty-two the sex was not stated.

AGE

Primary sarcoma of the liver may occur at any age. Two congenital cases have been reported and the others at all ages up to seventy-four, which is the oldest case recorded. In the list of cases accompanying this report are to be found seventeen under five years of age and seventeen over forty years of age. The average age for all reported cases occurring in patients over fifteen was 43.3 years as compared

with 47.5 in Rolleston's table. In many of the reported cases the age of the patient was not stated.

CLASSIFICATION

Rolleston classifies primary sarcomata of the liver as follows:

1. *Primary massive sarcoma.* There is a large tumor, usually in the right lobe, similar to the massive form of the primary carcinoma, in some cases projecting from under the surface of the liver so as to become pedunculated. Small secondary tumors may be found throughout the liver.

The cells may be small, round, spindle-shaped, or of various shapes and sizes. Hæmorrhage frequently takes place in the growth, causing it to assume a mottled appearance. Large sarcomatous tumors, following hæmorrhage, may break down into cystic cavities resembling abscesses. About one-third of all reported cases of primary sarcoma belong to this group.

2. *Nodular or multiple primary sarcoma.* There are a number of nodules scattered throughout the liver substance, which, when small and numerous, tend to become confluent. As in the previous class the cells may be of various types. This is said to be the most frequent form of the disease.

3. *Diffuse or infiltrating primary sarcoma.* Both lobes of the liver may be infiltrated in this variety. This form is most frequently seen in infants and at times care is required to differentiate it from the lesions of the congenital syphilis. It is characterized by large, endothelial cells and large quantities of hyaline fibrous tissue.

4. *Primary sarcoma arising in the cirrhotic liver.* This form is very rare, but two cases having been reported, one by Ford and one by Vecchi and Guerrini (3).

5. *Primary melanotic sarcoma of the liver.* The existence of this variety has often been questioned and while some such cases have been reported, it was suspected that they were really secondary manifestations of the disease, the primary growth having been overlooked. Pitt reports a case of a large, melanotic sarcoma of the liver, supposed to be primary, as no other manifestations of the disease could be recognized during life, in which the post-mortem revealed a small growth in the right uveal tract.

DEVELOPMENT

Primary sarcoma may arise from the connective tissue of the liver in the portal spaces, and from the perivascular connective tissue, from the Kupffers starlike cells around the capillaries and from the blood-vessels and the lymphatic endothelium. Those originating from the latter source should be classified as angiosarcomata, to which class many of the reported cases belong.

The microscopic arrangement of the sarcoma of the liver often resembles carcinoma because of the alveolar structure which is noticed in those growths of endothelial origin. This fact is responsible for much of the confusion concerning the real nature of some of these tumors.

Small round-celled, large round-celled, spindle-celled, giant-celled, lymphosarcoma, angiosarcoma, including the endothelioma and melanotic sarcoma, have all been found occurring primarily in the liver.

Sarcoma of the liver grows in two different ways: First by proliferation; second by invasion. Growth by proliferation or multiplication of the tumor elements tends to repulse, compress, or isolate the surrounding tissues so that the tumor seems to be incysted, a condition most favorable for extirpation but unfortunately less frequent than the others.

Growth by invasion of the surrounding tissues corresponds to the diffuse forms of sarcoma and is characterized by the deposit of embryoplastic elements irregularly in the vicinity of the tumor. These elements may be arranged as nodules or as an infiltration of the surrounding tissues and always faithfully reproduce the primitive type of sarcoma.

ETIOLOGY

The problem of the etiology of malignant diseases in general is yet unsettled and cannot be considered here.

The causes of sarcoma formation are very imperfectly understood. There seems to exist in some cases a certain predisposition, either individual or local, favoring the development of the sarcomata under the influence of external causes such as blows or repeated local irritations. Unquestionable examples of the con-

genital sarcomata are very rare, but two such cases being recorded. Some observers claim the cirrhosis predisposes to the development of these growths, but of this we have no definite proof.

PHYSICAL SIGNS

In the early stages of the disease the patient may present few signs of serious illness other than anæmia. Usually, however, emaciation is rapid and the well-understood signals of cachexia are displayed without much delay.

Sarcoma usually produces a very definite enlargement of the liver. The whole organ may be involved in the nodular growth or the tumor may be comparatively smooth, globular, and of great size, and, in those cases marked by hæmorrhage and degeneation, may simulate abscesses.

Jaundice and ascites are far less common with sarcoma than with carcinoma of the liver.

The ascitic fluid, when found, is not particularly characteristic as it has been found clear even in cases of melanotic sarcoma. Secondary anæmia is always present and œdema of the legs and feet is frequently observed.

SYMPTOMATOLOGY

According to Rolleston, the most common symptom of primary sarcoma of the liver is excessive weakness, which in the case observed by me seemed altogether out of proportion to the general physical condition of the patient. This is probably due to the hepatic inadequacy, the result of destruction of the liver tissue and pressure, and is marked by toxæmia accompanied by loss of appetite.

Nausea and vomiting may be present and while constipation is the rule, one case observed had persistent diarrhœa.

Pain is present in every case of primary sarcoma of the liver, and is due to the increased tension and stretching of the capsule. In some cases the growths involving the liver tissue capsule set up a perihepatitis, which still further increases the pain. The pain is constant and may be noticed in the right hypochondrium, the back, shoulder, or loins.

These symptoms usually increase steadily in severity and are quickly supplemented by rapid loss of weight and increase in the evidence of autointoxication, even to the point of stupor or delirium.

DIAGNOSIS

The diagnosis of tumors of the liver is very difficult. In forty cases the correct diagnosis was made only twelve times, according to Thomson (10).

Primary sarcoma has been known to simulate abscess. It is frequently impossible to determine the nature of the neoplasm and in many cases the presence of the tumor is all that can be established. It is scarcely possible to differentiate sarcoma from carcinoma, although the age of the patient, the rapidity of the growth, and the symptoms of greater local activity in sarcoma may assist us in making the diagnosis. Pepper (5) states that sarcoma runs a more rapid course and is less apt to be accompanied by jaundice or ascites than carcinoma.

Should the abdomen be full of ascitic fluid, a satisfactory examination of the liver cannot be made until the fluid has been removed. In cirrhosis the enlargement is more uniform, but the principal point in differentiation is the much greater rapidity of the process in sarcoma.

Gummata may simulate sarcoma of the liver. If the patient's condition will warrant the delay, vigorous antisyphilitic treatment should be instituted and the matter thus cleared up. The differential diagnosis between primary sarcoma of the liver and the hepatic abscess, while at times difficult, is not so important, as both demand operation.

The differential diagnosis of the primary and secondary malignant growths of the liver has thus been summarized by Rolleston (6):

Primary

No sign or symptom of growth.
No sign or symptom of growth elsewhere in the body.
A single tumor.
Very rapid growth.
Jaundice rare and slight.
Ascites infrequent.
Emaciation not so marked.
Course rapid.

Secondary

Some evidence of growth elsewhere.
Multiple tumors.

Less rapid growth.
Jaundice common.
Ascites common.
Emaciation marked.
Course not so acute.

PROGNOSIS

Hale White (7) states that the primary malignant disease of the liver probably never lasts more than four months.

Without surgical intervention the prognosis is always hopeless. Several instances of apparently permanent recovery following operation have been reported. It, however, is not to be denied that the general tendency of sarcomata is to dissemination and recurrence.

Recurrence may take place very rapidly. Dissemination takes place more slowly and in certain forms is rather exceptional, such as angiolithic and certain mycloid sarcomata, especially those with myeloplaxes. However, in sarcoma of the viscera, dissemination is the rule and it is to be feared that many cases will not prove amenable to treatment.

The medical treatment of primary sarcoma of the liver is palliative and need not be further considered.

Single primary sarcomota of the liver, when well localized and not too far advanced, should be removed by operation and these operations should be undertaken early, as the progress of the disease is most rapid. Delay in such cases in the efforts to make an exact diagnosis will usually result in the operative disclosure of the hopeless condition of affairs which might have been avoided by an earlier operation, even though it was admittedly exploratory.

I have been able to secure reports of twenty-eight cases of primary sarcoma of the liver which have been operated upon. In nine of these cases the operation was merely exploratory, and no effort was made to remove the tumor as it was clearly inoperable.

This leaves nineteen cases where a radical extirpation of the tumor was made, with ten immediate recoveries and nine deaths. One of these deaths occurred in an infant of four months, and the other in a child of eighteen months. One had no recurrence at seven months and another was well at two years; another had no recurrence and was working every day nineteen months after the operation and is still well and is daily improving in health and strength. The subsequent course of three of these patients was not given.

While these results following operation are not particularly flattering or brilliant, they are better than those following the non-surgical treatment of this condition which is attended by a mortality of 100 per cent, and it is fair to assume that the recent advances in liver surgery, particularly in operations undertaken for the extirpation of liver tumors, will greatly improve the results of similar operations undertaken in the future. L. Lilienthall (personal communication) suggests the use of Coley's antitoxin in these cases.

L. L. McArthur, in a personal communication, suggests the treatment of primary sarcoma of the liver by direct exposure to the X-ray. John A. Wyeth (personal communication) suggests the treatment of these tumors by streptococcic infection. A. J. Ochsner, T. S. Cullen, Roswell Park, John F. Bottomley, R. Matas and Leonard Freeman (personal communications) consider that circumscribed, solitary tumors without metastasis, should be considered amenable to surgical treatment, while W. J. Mayo (personal communication) does not think that a suitabe case would probably be encountered.

Surgery of the liver has made wonderful progress during the last few years. Ahlenstiel (8) says that the operative treatment of liver tumors was given remarkable impetus by the experiments of Ponfick (9), who showed that the liver endures such excessive inroads upon its tissue that when three-fourths of it has been extirpated it completely renews itself in a few months.

Then Nasse demonstrated experimentally that, when some tracts of the liver were put out of function by obstruction of the biliary ducts, these atrophied while others became hypertrophied by compensation. Remarkable operations followed these demonstrations. After Langenback, Lauenstein, and Tillmans had successfully removed constricted liver lobes, Lucke and Hochenegg dared to extirpate tumors of the liver; and at the twenty-second Congress of the Gesselleschaft für Chirurgie, von Bergman exhibited a man from whom he

had removed a malignant tumor and who had fully recovered with no recurrence a year later.

Terrier and Auvray (11) have written a very interesting article upon liver surgery, and presented a new chain-suture devised by Auvray for the control of hæmorrhages. Langenback (12) also published a comprehensive review of the same subject.

W. W. Keen reports three cases in which he has resected a portion of the liver with recovery in each instance, and prefers to rely upon the cautery and ligation for control of hæmorrhage.

A. H. Ferguson (personal communication), who has successfully removed a large primary sarcoma of the liver, and whose patient is alive and well nineteen months after the operation, employed mattress sutures through the entire thickness of the liver tissue inserted well beyond the confines of the tumor and then, slowly incising the liver tissue with a knife, caught the vessels with mosquito forceps before severing them and ligated them afterward with fine catgut. He stated that the hæmorrhage was in this way admirably controlled.

T. S. Cullen has had a large experience in liver surgery and has secured most excellent results, having made three resections and two repairs of lacerations of the liver with the recovery of all.

Cullen prefers to use a blunt needle very similar to that of Kousnietzoff, and controls hæmorrhage by suture.

Kousnietzoff has greatly simplified the problem of liver surgery by presenting to the profession his liver needles. These are simply curved and straight needles of suitable size without points, being rounded at the ends, and may be introduced into the liver substance without puncturing the vessels and thus avoiding hæmorrhage.

Mickulicz (quoted by Cullen) said: "To my mind, Kousnietzoff's needles represent the egg of Columbus in the technique of liver surgery."

To the testimony above offered in favor of these needles I wish to add my own, as I have used them in experimental work many times and once upon the human liver with complete satisfaction.

Having unexpectedly to repair a wound in a liver tissue, Cullen ingeniously substituted a Hagedorn for a Kousnietzoff needle, introducing its eye first, and found it to answer every purpose. In the same predicament, I once used a small silver probe which was furnished with an eye and which, by the way, answered very well as it could be easily adjusted to just the right curve.

In a former article (15) I described a new method of liver suture which I have found very very efficient in experimental liver resection in which are employed needles of the Kousnietzoff type. The method is as follows:

"This suture will permit the coaptation of a liver wound at the same time controlling the hæmorrhage without the necessity for packing, and will also permit the resection of large or small areas of the tissue for the radical extirpation of the liver tumor.

"Parallel with the wound in the liver or with the area to be excised and about one-half inch from its edge on either side, insert deeply through the liver substance by means of a large, round, blunt needle, shown in Fig. 1, a strand of No. 3 catgut. These needles, as well as the small, blunt needles, mentioned afterwards, are modifications of the Kousnietzoff's liver needles which have been so successfully used and have proved satisfactory. These strands should enter the liver tissue about one inch beyond the edge of the wound, run deeply through the liver substance and emerge the same distance from the opposite side of the wound. The ends of these catgut strands are now fastened by drawing them up snugly and tying to either end of both strands a small, ordinary skein of catgut, which, presenting a broad surface against the liver tissue, prevents the indrawing of the suture ends. Transverse, interrupted sutures (Fig. 2) of No. 3 catgut are now introduced by means of a small, blunt needle, also shown in Fig. 1, in such a manner that they engage upon either end of the wound, the long, buried strand of catgut. These may be tied as rapidly as introduced and exerting their traction upon the buried long suture may be tied snugly (Fig. 3) ensuring hæmostasis and coaptation without the danger of their cutting out.

"When it is desired to remove a portion of the liver tissue carrying with it a tumor, this may be done by excising between the buried long

sutures (Fig. 4) a wedge-shaped ellipse of liver substance and introducing the transverse sutures as above described.

"Hæmorrhage during this procedure may be controlled either by manual pressure or by elastic ligature until the transverse sutures are tied, when it will immediately cease.

"If desired, any large veins presenting along the cut surface may be tied as recommended by Keen, by placing a ligature about them with a small needle carrying fine catgut, which precaution in my experimental work I have found unnecessary. I have employed this suture once upon the human body during the removal of a large carcinomatous tumor from the liver, and found it very satisfactory. In many experiments upon dogs I have found that it was possible to remove various amounts of liver tissue up to one-half of the organ, beyond which I have not tried to go, and also that hæmorrhage from any sort of a wound, large or small, in the liver substance could be in this manner easily controlled.

"As the material used in this suture is plain catgut, which having served its purpose will be absorbed, the necessity for an open wound, gauze-packing, etc., may in most cases be eliminated."

I do not offer this method as one that is perfect, nor do I care to make any extravagant claims for it, as my experience with it has been limited. I offer it with the hope that, as the opportunity permits, you will try it and demonstrate its value or its shortcomings.

During the past few years, many tumors of various kinds have been removed from the liver and the subject of liver surgery bids fair to take its place in the front rank of the well-established, rational procedures.

It is this fact which offers a somewhat cheerful prognosis for these cases of primary sarcoma of the liver, yet there are many restrictions to its employment in such cases and the indications for and against the radical removal of these tumors should be carefully considered.

Cullen states these as follows:

"It is important to determine: 1. Whether the growth be malignant or not; and 2. If malignant, whether it is primary or secondary. In the case of metastatic neoplasms, as a rule, operation is contraindicated, inasmuch as they are usually multiple. Primary carcinoma or sarcoma of the liver is rare. Should the hepatic growth be primary, the glands along the vessels and at the base of the liver should be carefully palpated, to ascertain whether they have become involved. This point was first insisted upon by Tuffier. In cases of lymphadenoma, with secondary nodules in the liver, operation is not advisable. In all cases of liver growths the following points should be carefully considered: (a) Whether the growths are single or multiple; (b) The situation; (c) The size; (d) Whether they are pedunculated or not.

"If the growths are multiple and spread over a wide area, removal is difficult or impossible. On the other hand, provided that they are near the lower edge of the organ, resection is feasible. In fact, in the majority of cases, the situation is all-important.

"The size is of little importance when the growth is pedunculated and situated near the lower margin of the liver. In the case of a large tumor, however, located near the middle of the organ, removal is exceedingly difficult or impossible. If it is located near the edge, amputation is not difficult; but if it is near the middle of the lobe, a very large portion of the liver must be resected; otherwise a cavity is left which may be the source of an alarming or even uncontrollable hæmorrhage. When the growth lies near the portal vein or the hepatic arteries, operation is contraindicated, since large branches of these vessels are liable to be injured, with a resulting necrosis of correspondingly large areas of liver substance and the death of the patient. If the growth be pedunculated, its removal is easier, inasmuch as the liver substance forming the pedicle is much tougher than the other portions of the organ. This toughening is due to the partial atrophy of the liver-cells."

With these indications well in mind all suitable cases of primary sarcoma of the liver should be given the chance which surgery alone affords, as extensive resections of this organ may now be made without the fear of hæmorrhage which for years was the principal factor in restraining progress in the surgery of this organ.

I desire to report the following cases of primary sarcoma of the liver:

A. M., Irishman, aged sixty-two years, married, farmer, entered St. Joseph's Hospital, August 18, 1907, where I saw him in consultation with his physician, Dr. J. L. Rantz, of Canistota, S. D.

His previous history contained nothing of interest. Says he has never been sick in his life; has always had perfect health until three months ago. His usual weight was about 300 pounds. About May, 1907, he began to suffer severely from pain in the epigastrium, which he described as constant and boring in character, and which steadily increased in intensity. His physician at this time could discover no cause for his suffering upon examination. About a month later he developed a diarrhœa which persisted through his illness, the stools often containing blood and mucus. At this time his attendant discovered the existence of a tumor about the size of a man's fist in the region of the epigastrium. Now, in addition to the pain, the patient complained of feeling weak and this weakness increased rapidly until he could scarcely get about. A mild degree of anæmia together with some œdema of the foot and ankles also became manifest.

The tumor rapidly increased in size, the patient began to lose weight very rapidly and the weakness and diarrhœa became more and more pronounced. When I saw him, three months after he had first complained of being ill, he had lost sixty pounds in weight and presented some evidence of cachexia. He had been an extremely powerful man, of large frame and, despite his great loss of weight, still weighed about 240 pounds. He complained more bitterly of his great muscular weakness and debility than of any other symptom, and it was a marked feature of the case.

Upon physical examination the outline of the tumor could be plainly seen in the mid epigastric region. Palpation showed it to be a large, rounded growth about the size of a fœtal head, smooth in outline and but little movable. The growth felt firm and extended from the free border of the costal cartilages to the umbilicus. Remainder of the physical examination negative. I could not be certain either as to the nature or character of the tumor, but suspected that it might be of pancreatic origin and suggested an exploratory operation.

Operation, August 20, 1907. Immediately upon opening the abdomen the tumor was encountered, adherent to the anterior parietal peritoneum. These adhesions being separated, others were encountered binding it fast to the omentum, intestine, and mesentery. These were separated with much difficulty and considerable loss of blood, and it was some thirty minutes before I could sufficiently expose and mobilize the tumor to discover that it sprung from the right lobe of the liver, to which it was attached by a broad, short pedicle about three inches wide, one inch long, and one inch thick. As the patient's condition had become most alarming, I did not dare to prolong the operation by making a resection of the liver and hurriedly applied a pair of Doyen's flexible clamps with rubber tubing upon the blades, such as are used in visceral anastomosis, to the pedicle flush with the surface of the liver, and cut away the tumor. These clamps effectually controlled hæmorrhage, the rubber tubing preventing the blades from cutting through the tissue of the pedicle. Upon examination, no involvement of any other organ could be discovered and the glands on the inferior surface of the liver were not involved.

The large cavity was stuffed loosely with iodoform gauze and the wound partly closed. The patient required the most vigorous stimulation and was in the most critical condition for forty-eight hours, when he rallied and commenced steadily to improve. The clamps were removed at the end of forty-eight hours and no hæmorrhage followed their removal. The gauze packing was slowly removed and the wound satisfactorily closed by granulation. The patient made a slow but steady recovery and left the hospital September 29, 1907, in good condition. A letter received from him December 20, 1907, states that he has gained twenty pounds in weight and is feeling well, with as yet no signs of recurrence.

It was a source of regret to me that the condition of the patient positively contraindicated a resection of the liver tissue, as the prospect of a permanent cure would have been rendered much better thereby. I was also for the same reason denied the privilege of using my own method of liver suture described above.

No claim is made that the result in the above case will prove to be permanent, as the time elapsing after operation is far too brief to permit any such consideration. It is reported as an example of a most interesting and unusual pathologic condition.

Pathologic report by E. W. Meis, M. D.

The tumor was rounded and enclosed in a capsule, soft in consistency and irregular in outline. The cut section presented a grayish appearance and when the specimen was fresh a whitish liquid exuded from the surface. In the deeper substance of the tumor, bile was found. The growth weighed one pound and four ounces. The dimensions were four and one-half inches by two and one-half inches.

Microscopically, a large number of round and oval cells were found of varied sizes and shapes. In the center of the growth, the entire liver structure was destroyed and the sarcomatous cells were in a state of degeneration. The cells were not developed and no intercellular substance was present. The tumor is undoubtedly a sarcoma of the large, round-celled type. The vascular network was very conspicuous and formed a regular skeleton for the tumor, the cells being arranged around the vessels in the shape of a mantle.

Following is a complete list of the cases of primary sarcoma of the liver, including those

which came to operation and those revealed by autopsy. References to some twenty-six cases, the literature of which was not available for this study and which for that reason were not included in that as authentic cases, are also given. I wish to express my appreciation to Dr. Carl von Klein, of Chicago, for his most valuable assistance in the preparation of this article.

CASES OPERATED UPON

1. Von Bardeleben reports a case of primary sarcoma of the liver. Age and sex of the patient not given. Tumor extirpated by wedge-shaped converging incisions. Sutures in the liver tissue failed to hold and wound in the liver was stuffed with iodoform gauze. Recovery with no recurrence after two years.

2. Belfinger (17) operated upon a patient eight years old who has complained of pain in the region of the liver, loss of appetite, emaciation, and marked general debility. Tumor, dark red in color and with smooth surface, was removed and wound packed with gauze. Microscope showed round, red sarcoma. Further course unknown.

3. Bossosowski (18) made an exploratory operation in a boy three years of age and found an inoperable primary sarcoma of the liver and verified the diagnosis at autopsy.

4. Bossosowski (18), in the same article, reports another case in a boy of eleven years in which the lower border of the liver extended three finger breadth below the ribs. In the right a painful, fluctuating tumor the size of an apple was detected. By means of an incision parallel to the ribs the liver was exposed and fixed in wound and the abscess evacuated. Several smaller pus cavities were then discovered and made to communicate with the larger cavity by burning the partition through with a paquelin cautery, leaving a hole the size of a man's fist. The surrounding liver tissue was brittle and slate gray and examination of a fragment revealed an alveolar sarcoma. Good temporary recovery. Further course not stated.

5. Carmichael and Wade (19) made an exploratory laparotomy upon a male infant of four months with a liver tumor and found a large soft liver mottled with purple spots. No attempt at removal and the infant died twelve hours later. Autopsy showed a primary round-celled sarcoma.

6. Elliot (20) operated upon a woman of forty, removing an alveolar sarcoma, the size of two fists, from the liver by means of the thermocautery with ligation of the large vessels. The liver stump, four inches long and two-inches thick, was walled off by gauze packing. The patient recovered, but died four months later from recurrence in the intestine.

7. A. H. Ferguson, in a personal communication, reports a case of primary sarcoma of the liver in a man aged forty-three. There was a large tumor in the upper right quadrant of the abdomen compressing and depressing the stomach. Patient had lost forty pounds and was extremely weak. Operation June 29, 1906. The entire left lobe was liberated by cutting through its ligaments and dislocating it completely outside of the abdominal cavity. Mattress sutures, passing through the entire thickness of the liver well beyond the growth, were inserted by excision of the tumor. These sutures were tied sufficiently tight to control capillary hæmorrhage without cutting through the liver parenchyma. The peritoneum was then cut with the back of a knife. When a vessel was reached it was seized with mosquito forceps and cut. The forceps and the mattress sutures completely controlled the hæmorrhage. The vessels were then ligated with fine catgut. A large Mickulicz drain was firmly placed in the cavity and the abdomen closed to the gauze. Patient left the hospital September 3, and gained steadily in strength and weight. No recurrence at this date.

8. J. M. T. Finney, of Baltimore, in a personal communication reports an exploratory operation upon a patient, age and sex not given, in which a primary sarcoma of the liver was discovered which had progressed too far to permit of its safe removal.

9. J. M. T. Finney reports a second case in which an exploratory operation revealed a similar condition.

10. George Goodfellow, of San Francisco, personal communication, reports operating upon a man between twenty and thirty years old for primary sarcoma of the liver with fatal result. No further particulars.

11. George Goodfellow, San Francisco, personal communication, reports a second case similar to the first.

12. George Goodfellow, San Francisco, personal communication, reports a third case with same results.

13. George Goodfellow, San Francisco, same communication, reports a fourth case with fatal result. These cases occurred in young men between the ages of twenty and thirty years. Full particulars lacking

14. A. E. Halstead, of Chicago, personal communication, reports a case in a woman aged fifty. Six weeks before coming under his observation, patient noticed a tumor in the right hypochondrium. Was losing flesh rapidly. Operation revealed a tumor, light gray in color, attached to the under surface of the liver into which it merged. As an incision seemed inadvisable, the abdomen was closed. Autopsy four months later showed primary sarcoma of the liver.

15. A. E. Halstead, same communication, reports a second case in a woman aged fifty-six. Five months before coming under observation, the patient had pain in the upper right abdomen, accompanied by foul, light colored stools, loss of appetite and jaundice. Two months ago noticed a tumor in the right side of the upper abdomen. Has lost thirty pounds in weight. Operation revealed a large, red tumor growing from under the surface of the liver. Its removal was considered impracticable and after excising a small portion of it for diagnosis the abdomen was closed. Patient died two months later and the autopsy confirmed diagnosis of sarcoma.

16. A. E. Halstead, Chicago, same communication, reports a third case in a woman fifty-four years. Seven months previous had noticed swelling in the upper abdomen accompanied by pain, nausea, and vomiting,

weakness and jaundice, all of which, intermittent at first, had become during the last two months constant and severe. Operation revealed large, solid tumor extremely vascular and grayish red in color, connected with the under surface of the right lobe of the liver. Growth measured eight inches in length and six inches transversely. Wedge-shaped piece excised for examination and the wound in liver packed with gauze. Abdomen closed. Death one month later. Autopsy revealed sarcoma of the liver with numerous metastases.

17. Israel (21) reports an operation made upon a girl of fifteen for primary sarcoma of the liver which, at its junction with the liver, presented a surface of 15 square cm. The gall-bladder was first detached from the tumor. Then with a mildly glowing, knife-shaped, thermocautery the tumor was severed from the liver. As hæmorrhage became more and more profuse, Isreal placed above the line of cleavage an elastic tube twice around the entire right lobe and then, ligating with three strong, silk sutures, loosened the tube. Iodoform gauze was firmly pressed against the raw surface of the liver and brought out through incision. Patient recovered, to die three and one-half months later from metastasis. Microscopic diagnosis was telangiectactic angiosarcoma.

18. Krasnobazef (22) reports a case of sarcoma of the liver in a child eighteen months old. The physical signs suggested a subphrenic abscess, but at operation a soft sarcoma nodule was found and the autopsy revealed several others of the large round-celled type.

19. H. Lilienthal, New York City, personal communication, reports a case of sarcoma of the liver, age and sex not given, upon which he operated with fatal result.

20. H. Lilienthal, same communication, reports a second similar case.

21. R. Matas, New Orleans, personal communication, reports an exploratory laparotomy which disclosed an inoperable primary sarcoma of the liver.

22. Muller (23) operated upon an angiosarcoma in the right lobe of the liver which appeared in a young woman during gestation. The tumor was the size of a fist, bluish, covered with dilated vessels and broadly pedunculated. A strip of gauze was thrust through under the tumor, cut away and tied on each side. The tumor was excised without hæmorrhage, a few visible vessels ligated and the stump fixed in the wound. Recovery, followed by death from metastasis nine months later.

24. Peterson (24) reports a case of primary sarcoma of the liver upon which he operated successfully. Seven months later there was recurrence. No further particulars.

25. Peterson (24) in same article, reports fatal operation upon second case of primary sarcoma of the liver.

26. Peterson (24) reports a third case, giving no particulars other than that he operated unsuccessfully.

27. Skiffassowsky (25) removed a large, sarcomatous tumor the size of a man's head from the quadrate lobe of the liver with which it was continuous. The patient left the hospital two months later in good condition.

28. Knott reports a case described above.

CASES DISCOVERED AT AUTOPSY

29. Arnold (26) reports a case in which autopsy in a boy of fifteen years revealed the liver considerably enlarged, surface coarsely granulated, of yellowish color. In the right lobe a large tumor, with small surrounding growths. Secondary nodules in the lungs, pleuræ, mesentery and intestines.

31. E. R. Axtell (27) reports a case of a boy aged three and one-half years, in which the autopsy showed the liver to be greatly enlarged, weighing three pounds and ten ounces, with some perihepatitis on the posterior surface. The entire upper two-thirds of the liver showed no hepatic structure, but was thrown up in three masses, one of which sprang from the left lobe and pressed the diaphragm and the heart upwards; the second came anteriorly from the left border of the right lobe, which was a mass of new tumor material. Section showed a dark, brownish red mass, with occasional yellowish or creamy spots of fatty degeneration. In more recent areas section was light pink, studded with small red, brown, and yellow hæmorrhagic patches. Well-defined connective tissue trabeculæ were not found.

32. E. P. Boumann and J. G. Forbes report a case in an infant. Autopsy showed the liver occupying practically the whole of the abdomen. There were three main masses in which extensive small nodules were found on the surface in the substance of the liver. Microscopic examination of the small nodules showed the growth to be composed of collections of round cells invading the liver substance and separating the neighboring nodules by flattened and altered gland tissue or by inflamatory exudation and hæmorrhagic areas.

33. M. J. Belin (29) reports a case in a man forty-eight years old in which the post-mortem showed the liver much enlarged, blackened, soft, pliable and covered with prominences, which, however, did not form distinct tumors. Section showed a blackened surface emitting a black liquid. Microscopic examination showed the stroma composed of adult tissue, disposed in the shape of sclerotic islands and honey-comb structures, containing tumor cells in irregular masses with granular protoplasm and rounded nuclei.

34. B. Bramwell and R. F. C. Leith (30) report a case in which autopsy in a woman of twenty-five revealed the liver considerably enlarged and containing a cystic tumor of angiosarcomatous, spindle-celled type. There were small cysts lined with endothelium. The growth had evidently sprung from the connective tissue surrounding the perivascular lymphatic channels.

35. R. W. Burnot (31) reports a case in which the autopsy in a woman of sixty-three years showed all the organs, except the liver, fairly healthy and free from any extraneous deposits. Liver enormously enlarged, weight 16 pounds and 11 ounces, but enlarged uniformly so as to retain its normal shape. Surface covered with small flattened knobs, like buttons. Numerous small masses of deposit were scattered through the whole liver, varying in color from black to dirty white. Microscopic examination showed the structure to be sarcomatous.

36. C. W. Crispell (32) reports a case in a man aged seventy-four in which post-mortem showed the liver

cirrhotic, atrophied, and bound down at the lobus quadratus by strong adhesions. In the lower right lobe of the liver was a tumor, evidently primary, the size of a large orange, very pronouncedly separated from the hepatic tissue by a white fibrous band of tissue about two or three mm. thick. The contents were soft, pulpy, and sangineous. Microscopic examination proved that this central pulp consisted mainly of blood and broken-down or detached sarcoma cells, with occasional giant cells and newly formed blood-vessels, some with distinct endothelial linings, others merely channels formed by the sarcoma cells.

37. Deliphine (33) exhibited before the Pathological Society of London, a section of a primary sarcoma of the liver.

38. B. De Vecchi and G. Guerrini (34) report in the same communication a case in which the autopsy in a man of sixty-six showed the tumor contained numerous vessels of defective walls filled with blood, in places appearing like a cavernous angiosarcoma. Microscopic examination showed that the tumor consisted of accumulations of small, fixed cells, and especially towards the center larger cells with vesicular nucleus, granular protoplasm, and small drops of fat, also abundant mononuclear giant cells and signs of necrosis. In places biliary vessels, with thin epithelial cells, may be found as well as heaps of tumor cells.

39. De Vecchi and Guerrini (34) report a case in which autopsy in a woman aged fifty-eight, showed that the vessels of the tumor were few, empty with defective walls, with evidences of hæmorrhage in a few places. Microscopic examination of the tumor showed numerous cells, many elongated, spindle-shaped, with a vesicular nucleus, some large and round, others still larger, with numerous nuclear figures.

40. W.W. Ford (35) reports a doubtful case of primary sarcoma of the liver, associated with cirrhosis, in a man aged fifty-nine years. Autopsy showed the liver considerably shrunken, the surface hard, rough, and granular. Resection was performed with great difficulty, the fibrosis being irregular in distribution and practically no normal hepatic tissue left, the cut surface being pale gray. In the left lobe of the liver was a large tumor mass, about 5 by 8 cm. in dimensions, with a soft, white, friable center surrounded by a dense, hard, grayish white peripheral zone. Microscopical examination showed that the liver consisted of almost pure fibrous tissue infiltrated with small, round cells, only a few liver cells being left intact; fatty degeneration of the liver cells had taken place in some areas.

41. Frericks (36) reports a case in which the liver was greatly enlarged, weighed 13¾ pounds, surface and cross-section infiltrated with numerous large and small, black and white nodules. The liver tissue between these growths was icteric. In the left branch of the portal vein was an old thrombus. Was diagnosed as pigmented, spindle-cell sarcoma. Retroperitoneal lymph glands were infiltrated; in the lungs and pleuræ were also a few small nodules. Otherwise no metastases. Nothing said about the eye and skin.

42. S. J. Gee (37) reports a case of primary sarcoma of the liver in a male, aged five months. Post-mortem showed the liver greatly enlarged. All the lobes were studded with round, white, tough growths of varying sizes, up to that of a peeled walnut. Large quantities of liver structure were left unaffected between the new growths. On microscopic examination, the morbid growths were seen to consist of a dense, fibrillated stroma, with small meshes, packed full of oval cells of uniform character, about twice the diameter of a red corpuscle, containing several glistening particles, but no distinct nuclei.

43. J. de Haan (38) reports a case of primary multiple alveolar angiosarcoma of the liver in a four months old child. On section the liver showed numerous blood-filled cysts. There was hardly any normal hepatic tissue to be seen, its place being taken by rounded areas of varying size, exhibiting a grayish color with dark centers. Microscopic examination showed a network of dilated capillaries, containing in its meshes numerous small round cells. The endothelium of the vessels was swollen; the cells assumed a more or less rounded form and closely resembled the tumor cells. Hæmorrhages were found in most of the large tumors.

44. G. Heaton (39) records a case of congenital, round-celled sarcoma of the liver in a child of eight weeks. Post-mortem, the liver weighed forty-nine ounces. Uniform, its lobes equally affected, covered with numerous red patches, separated from one another by pale red areas. A careful microscopic examination showed the areas of a small celled growth corresponding to the pale patches seen by the naked eye, cells uniform in size, packed together. The liver cells showed a considerable amount of alteration, being atrophied, and, in many instances, so changed that their distinctive characters were lost, and they appeared as irregular atrophied cells. Numerous sections showed sarcomatous infiltration along the connective tissue septa containing the blood-vessels.

45. Holsti (40) reports a case of primary melanotic sarcoma of the liver in a woman aged fifty-two. Post-mortem examination showed the following changes in the liver: The color of the surface was spotted dark brown and grayish red. Over the darker parts the surface was uneven and scattered with dark grayish button-like growths of a soft consistency. A very large mass of similar soft tissue was found adherent to the suspensory ligament and adjacent liver tissue. This was divided into large lobes, containing a fluid, grayish brown mass. The parenchyma had a similar spotted color, the darker parts predominating. Microscopically, it was found that the normal liver structure had almost entirely disappeared. There was a large number of round and oval cells of variable size filled with dark pigment, which was also detected in the tissues outside the cells in the form of granules. There were similar growths scattered over the peritoneum, omentum, and the heart muscle immediately under the endocardium.

46. Horup (41) reports a case in a woman aged forty-six years in which the autopsy showed the weight of the liver to be about six pounds. The tumor was situated towards the convex surface of the right lobe, measuring about five inches in any diameter. Micro-

scopical investigation showed the tumor tissue to consist largely of round cells, imbedded in scanty, finely granulated, intercellular tissue, while everywhere were interspersed firmer trabeculæ, consisting of spindle cells, of which several were larger and more granular, and were likewise connected by scanty intercellular tissue. The softer, more mucilaginous cells had the structure of mucous tissue. The neoplasm, as a peripheral section showed, developed especially from a granulation at the adventitia of the arteries.

47. K. H. Jones (42) reports a case of primary sarcoma of the liver in a male aged twenty-five. Post-mortem showed the liver greatly enlarged weighing 11 pounds, 6½ ounces, closely studded all over with slightly raised rounded or oval whitish nodules. On section the liver tissue was found to be largely replaced by masses of sarcomatous tissue, from one-half inch to two inches in diameter, all very friable, some breaking down in their centers, while hæmorrhage had taken place into others. Microscopically, the tumors were found to consist of a general infiltration of the lobules of the liver with small round cells.

48. C. von Kahlden (43) reports a case in which autopsy in a man of thirty-two years showed an enlarged liver covered with numerous small and confluent nodules, some white, some yellowish in color. In the tissue that was still preserved, the ascini showed a retracted brown color and a swollen, yellow periphery. Microscopically, the tumor was found to be a round-celled sarcoma that apparently sprang from the endothelium of the blood-vessels.

49. A. A. Kauthack and E. L. Lloyd (44) report a case of primary sarcoma of the liver in a woman aged 70. Post-mortem showed a soft, spongy, semi-fluctuating mass of growth, about as long as a cricket ball occupying the right lobe of the liver, which is elongated to a point below the umbilicus, and containing many secondary nodules of growth. Microscopic examination showed many areas of irregularity, where the liver cells were replaced by a mixed celled new growth. The cells, separated by a very slight, delicate, mucilaginous substance, vary much in size and shape, some being large and irregular and others smaller and spindle-shaped, and yet others round and oval.

50. W. S. Lang (45) reports a case in a woman of twenty-seven years. At the post-mortem a large amount of straw-colored liquid was removed. The liver at once presented itself with several large white nodular masses visible. The liver had slight adhesions to the duodenum: weight 13½ pounds and filled with large round masses of new growth. Some of the masses at the surface were soft and semi-fluctuating; the growth proved to be a round-celled sarcoma undergoing degeneration and caseation.

51. Leisering (46) observed a round-celled sarcoma in a goat, aged less than a year. Post-mortem showed the liver enlarged to about twelve pounds weight. Twelve, hard, yellowish, globular tumors, ranging in size from a walnut to a fist, sharply distinguished from the surrounding liver parenchyma, projected from a surface of the liver. Sections of these neoplasms glistened and pressure with a knife expressed a turbid liquid from within. Under the microscope parenchyma of the tumor showed the elements of a round-celled sarcoma.

52. Lendrop (47) gives a case of an infant of about four months. Large tumor in the abdomen. No jaundice. At necropsy the liver was found to contain numerous disseminated tumors consising of small round cells which seemed to originate in the endothelium of the interacinous blood-vessels and penetrate into the veins, where they compressed the liver cells.

53. J. W. Legg (48) reports a case of doubtful primary melanotic sarcoma of the liver in a man aged forty-two. Post-mortem showed the liver weighing 9½ pounds, preserving roughly, its natural shape with capsule somewhat roughened, covered with small, yellowish white, opaque spots, from the size of a pin point to a pea, the latter apparently formed by confluence; also deep green prominences varying from the size of peas to apples, small in the left, large in the right lobe. On section, these tumors were seen to hold a dark green, pulpy substance, bounded by a thick, white capsule which in some cases sent in septa. Microscopic examination showed on the outside of the capsule, several layers of firmly compressed liver cells, almost spindle-shaped from pressure, and cells resembling the liver cells within, accompanied by quantities of green granules. I am inclined to believe that this is a case of primary sarcoma of the liver.

54. M. Litten (49) reports a case of melanotic sarcoma of the liver in a man aged thirty-seven. Post-mortem showed the liver enormously enlarged, inky black, hard, smooth, not granulated on the upper surface, and dotted with large protuberances of varying size, fluctuating in some cases collapsed and filled with an inky fluid. This fluid contained polygonal cells, in many cases rounded, with masses of granules of black pigment. Microscopic examination of the tumor tissue showed that it consisted mainly of spindle-cells, and in lesser degree of small round cells. The cells had, however, since they were almost without exception full of pigment, of ten lost their characteristic form and become round or polygonal.

55. H. Marx (50) reports a case of primary sarcoma of the liver in a man of fifty-two years. The liver was enormously enlarged. Its upper surface was knotted with numerous, slightly prominent tubercles. The surface of the tubercles either had the appearance of the liver tissue or else brownish red, often hæmorrhage on the summit. On section the liver proved to be sown with bulky tumors of the most diverse sizes. On microscopic examination the large masses proved to be mainly coagulated blood, with masses of fibrin appearing partly as thick trabecula with alveolar spaces between partly in a fine network within those spaces. The tumor tissue was composed of uniformly large, but variously shaped cells, mostly round or polygonal. The liver itself showed in places extreme infarction and impregnation with biliary coloring matter. The interlobular connective tissue was in places thickened and showed infiltration of small cells, especially around the blood-vessels and bile ducts.

56. Meisenback (51) reports a case of myxosarcoma

of the liver in an infant aged four months. Post-mortem: Liver presented smooth, symmetrical enlargement, color mottled, like red castile soap. Peritoneum slightly reddened. Liver enlarged, filling entire abdominal cavity bulging up under the xiphoid cartilage, with inferior in the hypogastric region.

57. Millard (52) reports a case of primary sarcoma of the liver in a woman of about forty; apparently connected with an early menopause, eighteen months later a number of small, spherical tumors in the subcutaneous tissue developed in addition to the primary growth. The microscope revealed sarcoma of the spindle-celled type.

58. B. Naunyn (53) reports a case of a woman aged sixty-two. Post-mortem investigation showed sarcomatous tubercles the size of a millet seed, scattered on the surface and in the interior. In the center of the liver a cyst was found which the author states was similar to that frequently found in cystic sarcoma of the mammæ.

59. R. W. Parker (54) reports a case of diffuse (?) sarcoma of the liver (probably congenital) in an infant aged five weeks. A partial autopsy showed the liver filled the abdominal cavity, its weight being thirty-two ounces. The appearance of the liver was a bright scarlet after removal from the body. When cut into, the color of the new growth was the same as the liver. The new growth was scattered throughout the entire gland as nodules, varying in size from a millet seed to a walnut. It looked not unlike caseous material but it could not be shelled out of the liver substance. The upper surface of the organ was irregularly though slightly nodulated; its capsule was shiny, and did not appear to be thickened.

60. Pellicani (55) reports a case of primary sarcoma of the liver, age and sex not stated. Post-mortem showed that the liver weighed 3,500 gm. and contained a tumor measuring 88 mm. in diameter, consisting of fusiform elements of varying lengths, and in the vena cava ascendens a very similar microscopic tubercle, which continued in attenuated form and was prolonged into the right auricle of the heart.

61. F. G. Penrose (56) reports a case of sarcoma (probably congenital) of the liver in a woman aged forty-four. Post-mortem showed the liver enlarged, weighing 13½ pounds. There were apparently no true liver cells left, and the cells of the growth were of a sarcomatous type.

62. W. Pepper (57) reports a case of congenital sarcoma of the liver in a female infant aged one month. The liver could be felt either pushed forward or much enlarged. The child died aged six weeks and the autopsy revealed a uniformly enlarged liver weighing two pounds and six ounces, bulging out below the costal border and filling the abdomen almost completely. Section of the liver showed it to be thoroughly infiltrated, almost transformed in fact, into a lymphosarcoma, which had not changed the shape of the organ at all. Small islets of the liver cells remained, completely surrounded and compressed by the growth.

63. W. Pepper (58) reports a case in a child of eight weeks. In good health until ten days before death. Post-mortem: Liver encapsuled by half-coagulated blood. Right lobe of the liver normal; tumors in gall-ducts of the left lobe. Network of large meshes, containing mononuclear cells. Diagnosed as carcinoma but undoubtedly was a sarcoma.

64. K. Pichler (59) reports a doubtful case of primary sarcoma of the liver. Post-mortem showed the liver greatly enlarged, weighing 6200 gr., 34 cm. wide, 30 cm. long and 13 cm. thick. The outer surface of the liver was thickly sprinkled with numerous black and less numerous whitish gray spots, about 1 cm. in diameter. The neoplasms so permeated the liver that only islands of the liver parenchyma remained. Microscopic examination showed clearly how the melanotic, spindle-celled neoplasms had developed within the blood-vessels, between the liver-cell trabeculæ.

65. G. M. Pitt (60) reports a case of sarcoma of the liver in a male aged ten months. Autopsy showed two pints of bile-stained fluid in the abdomen, one large mass of growth in the greatly enlarged right lobe of the liver, with numerous secondary nodules scattered about. Microscopic examination showed that the tumor was a very vascular small round-celled sarcoma.

66. Podrouzek (61) reports a case in which the autopsy, in a woman aged sixty years, showed the liver extended from the right second rib to below the umbilicus. The whole right lobe was taken up by the tumor, while in the left lobe only solitary nodules were found. Sarcoma of the spindle-celled variety. No metastases. All other organs normal.

67. Wm. Roberts (62) reports a case of cancer of the liver in a girl aged twelve years. Post-mortem showed that almost the entire right lobe of the liver was converted into an enormous oblong tumor. The left lobe was free from the disease, but enlarged to more than double its normal size. The tumor was 13 inches long by 12½ inches broad and 5½ inches thick, and weighed about eight pounds. On section the tumor showed encephaloid matter, masses of extravasted blood, and many cysts. The encephaloid masses were soft, reddish white, vascular, some beginning to break down into a semi-liquid, grumous matter; varied in size from an orange to a walnut and were chiefly situated in the lower and posterior parts of the tumor. The hæmorrhagic masses were composed of soft, clotted blood mixed with disintegrated matter. There were eight or ten cysts. The two largest now partly collapsed and half-full of turbid, reddish, purulent matter, had been punctured during life. The broken cysts varied in size from a marble to a small apple; some contained a jelly-like substance, others clear yellow serum. (Evidently a sarcoma.)

68. de Ruyter (63) related a case in a child of ten days. Post-mortem showed that the liver was hidden by a tumor extending from the costal border to the symphysis. The tumor had preserved the exact form of the liver in which it had developed. The liver, or more properly, the liver tumor was 20 cm. broad, 12.5 cm. high and 6.5 cm. thick. The whole organ was enlarged proportionately. The capsule was moist, smooth, and glistening and through it showed a yellow, speckled, brownish red tissue. Section through the

liver showed it to be very rich in blood, and that it was made up of a partly yellowish and partly grayish red marbled tissue. In a few places were some irregular shaped multinucleated cells, which were thought to have been remnants of the old liver cells.

69. H. H. Tooth (64) reports a case of diffuse lympho-sarcoma of the liver, in a female child aged five years. Post-mortem, weight of the liver forty-eight ounces, pale in color, and firm in consistence. No isolated growths, in fact nothing to suggest a great overgrowth of connective tissue. Microscopically small round celled leucocytes. The lobules were separated from one another, and the gland cells themselves were in parts completely surrounded by small celled growths.

70. U. S. Marine Hospital Service, St. Louis (65), reports a case of a male, aged thirty-three years. Autopsy showed the liver dark on surface, covered with round protuberances, enormously enlarged, weighing about fifteen pounds, filling the entire right side of the abdominal cavity and crowding the intestines over to the left. On section the liver proved an almost solid light yellow, densely cartilaginous growth, retaining only a few isolated patches of normal liver tissue.

71. E. Wagner (66) reports a case in a boy of five and one-half years, of feeble constitution. Eight days before the first symptoms (17th March) a piece of wood had struck the abdomen. Died May 14th. Post-mortem: The surface on cross-section showed numerous whitish nodules especially profuse along the branches of the portal vein. Mesentery, peritoneum, and intestinal wall infiltrated with tumorous masses. Diagnosed as primary lympho-sarcoma.

72. S. West (67) reports a case of sarcoma of the liver in a female aged fifteen. A large mass was found on the under surface of the liver above the portal vein, involving the vena cava inferior, completely plugging it from above the entrance of the renal veins, and extending up to the heart, where it formed a mass in the interauricular septum. There was one nodule to the right lobe of the liver and another to the spleen. The tumor resembled a mass of gummata. Microscopic examination, however, proved it to be a fibrous sarcoma which had undergone extensive caseous degeneration.

73. C. West (68) describes a case in a child of eight months where at a necropsy a medullary sarcoma of the right lobe of the liver was found. West describes this case as being a cancer, but from the description it must be regarded as a primary sarcoma of the liver.

74. Windrath (69) reports a case of primary sarcoma of the liver in a male, young, age not stated. The enlarged liver showed beneath the surface and throughout the substance, a number of firm, grayish red, new growths, varying in size from tiny specks to walnuts or pigeon eggs and light red or grayish white on section. Microscopic examination showed the cells to be small, spindle-shaped, with slightly granular or homogeneous protoplasm and oval, deeply stained nuclei.

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DEPARTMENT OF TECHNIQUE

FRACTURE OF THE EMINENTIA CAPITATA

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The observations on fracture of the capitulum humeri are so few, and the reports so imperfect in detail, that no positive statement is possible regarding certain important points essential for an accurate description of the injury.

I report the following case of my own, and quote the records of the cases to be found in literature in an effort to co-ordinate the known facts:

Case record: William Daniels, aged 40. July 9, 1907, fell 12 feet through trap-door, landed on flexed elbow, striking on outer side. No mark on elbow at time of injury. After 15 minutes arm began to stiffen, becoming more and more painful. Forearm held flexed at about 90 degrees, elbow swelled. This swelling, in the course of two days, extended to wrist and upper arm; on about third day turned black and blue. No active motion because of pain. Treated in right angle splint.

September 6, 1907, applied at Roosevelt Hospital because of inability to use his arm, and examined for the first time by me. Left forearm fixed at about right angles to humerus and semiprone. Slight atrophy of entire left arm compared with the right side (right-handed man). Fullness in bend of elbow and about external aspect of joint. Bony prominence in bend of elbow felt anteriorly and to outer side of elbow. Depression above head of radius sufficient to palpate a small portion of the upper surface of the head of the radius behind. Induration about external condyle posteriorly.

Pronation and supination, active and passive good, both limited a very little. No active flexion or extension. Passive extension about 5 degrees. Flexion limited by firm resistance; if forced, not painful. Extension limited by elastic resistance. If forced, patient complains of pain.

Relation of condyles to each other, to the shaft of the humerus, and to the bony landmarks of radius and ulna, normal.

Radiograph shows a section of the lower end of the eminentia capitata turned forward (Fig. 1*a*).

Clinical diagnosis. Fracture of the eminentia capitata. Prepared for operation.

September 7, 1907. Operation. Gas and ether. Postero-external incision of Kocher carried down over head of radius; fascia and combined tendinous expansion of triceps and fascia, divided in direction of skin incision. Anconeus divided, and fibres of supinator brevis pushed down after separating from capsule.

Extensor carpi ulnaris pulled forward; joint opened by curved incision, starting in front over the neck of radius and extending outwards and upwards to the external condyle, thereby skirting the displaced fragment of bone over which the capsule is stretched tightly; on opening the joint, the eminentia capitata was found turned up anteriorly. A very narrow rim of capitulum had remained attached behind to the diaphysis, as evidenced by a narrow crescentic margin of cartilage. The two fracture surfaces were at right angles to each other. The anterior half of the rectangular gap was filled by the head of the radius, the rim of which rotated freely on the anterior half of the fracture surface of the displaced fragment, a new articular facet having formed in the region of contact. (Fig. 1*c*). The proximal portion of the gap just above the concave upper surface of the head of the radius, i. e., the space between this and the posterior attached remnant of the eminentia capitata, was filled with newly formed connective tissue and granulations.

The fragment rotated forward, as it were, on its posterior margin by 90 degrees; is so firmly imbedded in connective tissue and fixed by the capsule that it can be moved but very little from side to side. An osteotome was made use of to effect its removal. The fragment lay entirely within the joint, and, after removal, was found to have attached a very narrow rim of trochlea. The cartilage was in good condition, which fact, together with the newly formed facet for the radius and pink appearance of the spongeosa, led me to conclude that, within the mass of connective tissue which bound the fragment to the diaphysis, there must either exist the normal periosteal attachment or new-formed vascular supply.

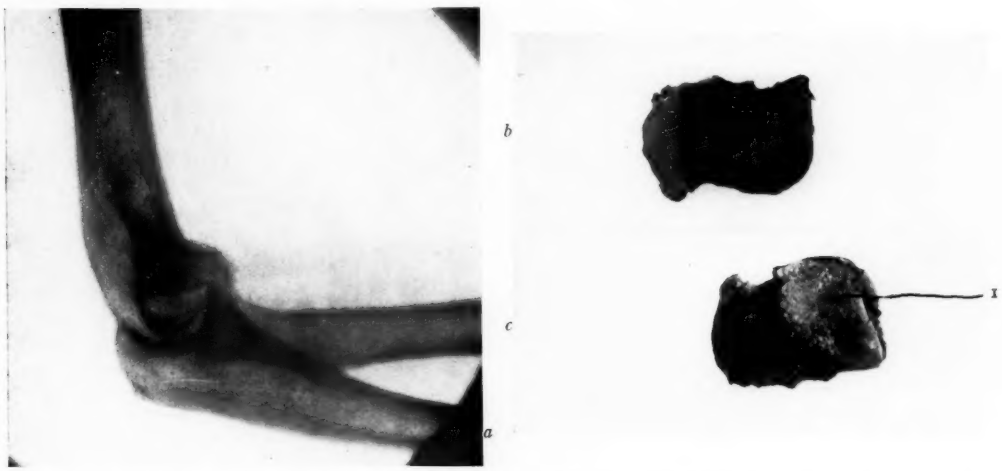

Fig. 1. Author's case. *a*. Arm at about 90°, showing eminentia capitata displaced upward. *b*. Anterior view of fragment with rim of trochlea. *c*. Articular faces worn in under surface by head of radius (1).

After removal of the fragment, the elbow could be flexed and extended through an arc of about 125 degrees, i. e., flexion to 45 degrees, extension to 170 degrees. The joint capsule and fascia were sewn with interrupted chromic gut, the skin with interrupted silk. Dry dressing, acute angle, moulded plaster splint, external.

September 14, 1907. Uneventful recovery, local reaction slight, moderate pain for two days. General reaction insignificant. Temperature to 100, after operation to normal on second day. Arm moved through an arc of 15 degrees; on 7th day massage and passive motion. Discharged.

October 10, 1907. Re-examined. Slight depression at seat of operation. Pronation and supination each slightly limited, active flexion to 75 degrees, extension to 135 degrees, i. e., through an arc of 60 degrees. Passive motion, slightly more and limited by pain.

December 11, 1907. Depression above radius filled out. Slight fullness about external condyle. About 15 degrees increased valgus compared with the other side, arms extended to the same degree. Pronation and supination normal. Extension to 160 degrees, flexion to 45 degrees, i. e., motion through an arc of 115 degrees.

Hahn's case: Female, 63, brought drunk to hospital. On regaining possession of faculties, complained of pain in right arm. Examination showed swelling, heat, arm at about 90 degrees flexion. No active motion. Passive motion in every direction caused pain. Crepitus beneath external condyle. Exact diagnosis not made out because of swelling. Local applications until swelling reduced. On second examination, bony landmarks of humerus and ulna in normal relation. In front of external condyle a rounded, hard protuberance, considered at first to be a piece of the head of radius, then found not to move on pronation and supination, whereas a prominence below and behind did rotate; hence, opinion changed to diagnosis of fracture of neck of radius. Seizing the two fragments separately and moving gave crepitus. Much limitation of motion. Arm placed at right angles with pad behind, over prominence below, and another pad in front over upper prominence. Error of diagnosis found on autopsy. Dressing remained 5 weeks. Examination then showed that the abnormal prominences had remained the same. No anchylosis but flexion and extension much limited. Pronation and supination normal. Condition of woman's arm remained the same until death from apoplexy 4 years later.

Specimen: Anterior and posterior fovea of lower end of humerus filled with new-formed bone. Eminentia capitata broken off at base and at external margin of trochlea, pushed upwards and anterior, forming almost a right angle with the external condyle. The fragment is firmly fixed in the lesser fovea normally for reception of the head of the radius on flexion. The fracture surfaces, i. e., the posterior of the eminentia capitata and the anterior of the external condyle, form a

A
A. a. Die fracturirte und mit ihrem obern Rande durch Callusmasse in der vordern, kleinen Grube des Oberarmbeins befestigte Eminentia capitata.
b. Die von den Bruchflächen gebildete Höhle, in welcher das Capitulum radii aufgenommen ist.
c. Die normale Gelenksverbindung des Capitulum radii mit der Ulna.
d. Das von der äussern Seite der vordern Fläche des Condylus externus abgehende, gegen den Processus coronoideus ulnae gerichtete, gleichsam ein Dach über die Eminentia capitata bildende, hakenförmige Knochenplättchen.
B. a. c. d. gleichbedeutend wie bei A.
e. Das von der vordern Fläche des Condylus internus gegen den Processus coronoideus ulnae herabgehende Knochenplättchen.
B
d
a
c

Fig. 2. *A*, *a*. Broken off eminentia capitata fixed in anterior fossa of upper arm by callus. *b*. Fossa formed by fracture surfaces into which capitulum radii is received. *c*. Normal articulation between radius and ulna. *d*. Hook-like plate of bone arising from outer portion of anterior surface of external condyle and extending toward the coronoid process of the ulna—like a roof over the eminentia capitata. *B*, *a*, *c*, *d* same as in *A*. *e*. Rate of force arising from anterior surface of internal condyle and extending toward the processus coronoideus ulnæ.

deep cavity with ivory-like wall, into which is received the head of the radius. The head of the radius is in normal relation to the lesser sigmoid cavity. Relation of olecranon to humerus normal. The groove for the ulna nerve has been greatly deepened by the surrounding new-formed bone. From the anterior surface of the external condyle a hook-like plate of bone extends over the displaced eminentia capitata obliquely, without touching this, towards the coronoid process. A similar process extends outwards from the anterior surface of the internal condyle towards the coronoid (Fig. 2).

Wright's case: A boy, 12 years of age, brought to clinic, October 26, 1878. One month previous, fell and struck flexed right elbow against a wall. Much pain and swelling. Anterior angular splint; no fracture or dislocation discovered. Fluctuation over head of radius, redness, swelling. Pronation and supination normal. Flexion and extension amount to about 40 degrees. No great pain on moving joint.

October 29th, chloroform, incision over head of radius. On opening the joint, it was found there had been a capitular fracture, the part broken off corresponding in size to the part developed from the capitellar nucleus. The injured bone was inflamed, cartilage peeling off; while about the seat of fracture, head of radius, and stretching across greater sigmoid notch of ulna was found well-marked "pulpy" granulation tissue, which had begun to produce erosions at the margins of the cartilages. Joint contained old blood clot and seropurulent material. The report states that the joint was excised because of the pulpy, strumous character of the granulations.

Steinthal's case: Male, 20; May 28, 1897, fell while jumping over a fence, in such a manner as to strike first on the flexed right elbow, and then on the outer side of the arm the external condyle. He continued to work for a few hours, but was obliged

Fig. 3. Cotton's case. *x* shows loose fragment in front of external condyle. *y* shows apparently the gap from which fragment came.

Fig. 4. Stimson's case 2. Description obtained from Stimson by author.

Fig. 5. Stimson's case 3. Description obtained from Stimson by author.

to stop because of pain until May 31st, during which time he applied local remedies. He then worked from June 1st to 9th, when a sudden pain in the right elbow, while carrying a load, caused him to seek a physician, who made a diagnosis of fracture of the head of the radius. Plaster of Paris was applied, later massage and passive motion. Interference with motion persisted so that, September 11, 1897, application for admission to the hospital was made. On examination, there was slight swelling on the radial side of the right elbow. Active flexion to 135 degrees, extension to 150 degrees, and, on extension, slight abnormal valgus. Olecranon, coronoid, condyles, and epicondyles in normal relationship to each other. In the bend of elbow, in front of external condyle, a bony swelling can be felt the size of a hazel-nut. This swelling does not belong to the head of the radius, which can be felt on pronation and supination in its normal place. Pronation and supination produce crepitus in the bend of the elbow. The X-ray shows head of radius pressing against the bony protuberance coming from the external condyle. Diagnosis, fracture of the external condyle. Operation, September 22, 1897. Chloroform, tourniquet. External incision 10 cm. long, joint opened. Head of radius intact, but does not come in contact with the articular surface of the eminentia capitata. This is displaced upwards and anterior and fixed in its new position by means of callus. Some granulation tissue was found in the region of the posterior part of the capsule. The crepitus is produced by the head of the radius rubbing on the callus beneath the dislocated eminentia. Fragment removed with chisel, also the head of radius, thereby producing an interspace of 2 cm. to prevent bony anchylosis; joint packed with sterile gauze, silk sutures in skin. Wound healed kindly, and on September 30, active and passive motion started carefully. Subsequently the joint would occasionally swell after motion, but the final result was flexion to beyond 90 degrees and extension to 160 degrees.

Cotton's case: Female, 40, fell, on January 24, 1902, six steps and struck on left elbow. Two days later brought to hospital, at which time there was much swelling and discoloration. Internal angular splint, at 90 degrees. To return for massage. No definite diagnosis. X-ray plate taken. Patient seen by Cotton six months after injury, at which time could use arm moderately, but much pain after use, especially at night. Slight, general thickening about the elbow, notably in front of external condyle. At this point an abnormal mass, hard and moderately movable, can be felt. Extension of elbow checked at 40 degrees beyond right angles, i. e., at 130 degrees extension, flexion to 90 degrees only. Pronation and supination much limited. Rotation, especially supination, brought out soft crepitus, at about the region of the fragment. Radiograph (Fig. 3) showed the joint normal except for the loose fragment which, from its outline, is determined to be the articluar portion of the external condyle.

Patient refused operation.

Professor Lewis A. Stimson's courtesy enables me to add certain data to the case references mentioned in his work on fractures and dislocations. I am also permitted to make use of a further, as yet unpublished, case of fracture of the eminentia

Fig. 6. Stebbins' case. Arm acutely flexed. Lateral view.

capitata, the details having been given me by Professor Stimson from his personal records.

It gives me pleasure to express here my gratitude for the aid rendered me by this master of the surgery of fractures and dislocations.

Stimson's case 1: Adult male, elbow struck by falling heavy stone, direct violence, injury compound elbow dislocated, upper and posterior extra articular portion of olecranon broken, and on operation the eminentia capitata found separated from the humerus and broken into two pieces, which were removed. There was much bruising of the skin and injury to soft parts in this compound injury and subsequent suppuration necessitated excision of the lower end of the humerus.

Stimson's case 2: Adult, male, arm caught between a tug-boat and a float. The exact method unknown. Large hæmatoma, small wound in skin. On operation, lower two-thirds of capitulum found broken off and rotated back, being attached posteriorly to the diaphysis (Fig. 4). Fragment tacked in place with periosteal sutures placed on outer side of capitulum; good result.

Local reaction, pain, swelling, loss of function, were comparatively slight and slow in appearing.

Stimson's case 3 (unpublished, record given me Professor Stimson): A boy, 12 years old, fell in the street, arm caught under him. No immediate complaint. One month later complained to family. At the end of two months seen by Stimson. Flexion to 90 degrees. Extension almost complete. Mass in front of external condyle, a gap felt behind and below. X-ray shows mass in front of condyle above head of radius. External incision (antero external, external lateral, ligament slightly freed).

Fragment removed with chisel, except for lower portion left because of pieces of articular cartilage.

Stimson anxious because of leaving this, but subsequent examination showed arc of motion not interfered with.

Stebbins' case:[1] Female, 24. Date, December, 1907. Fell on semiprone extended arm and hand. There was immediate pain and swelling of moderate degree. Functional disability was almost complete because of pain. Flexion and extension possible on passive motion. Extension limited 15 degrees. Arm held semiprone and

a *b*

Fig. 7. Stebbins' case. *a*. Arm at about 100° lateral view. *b*. Antero posterior.

[1] Dr. Stebbins, of Springfield, Mass., has graciously permitted me to utilise his record of a case which has recently come under his care, for this courtesy I beg to express my thanks. The importance of the additional data contained in this report will be emphasized later, as the case represents a most valuable addition to the subject.

Fig. 8. Stebbins' case. Arm extended. Fragment forced back into place.

flexed 15 degrees; crepitus present, rotating radius — no ecchymosis. No disturbance of bony landmarks. Very slight increase of valgus with arms in same position. A depression felt below external condyle behind and upper part of head of radius could be felt.

A mass felt in bend of elbow in front of external condyle. Flexion limited by bone at first extension by pain. On flexion the bony mass in bend of elbow appears, on extension disappears — the fragment apparently falling back into place (Fig. 6, 7, 8).

Stebbins determined to treat the break by placing the arm in complete extension.

Kocher's case 1: Male, admitted February 8, 1889. On January 17, 1889, fell ten feet, landed on palm of extended left hand. In about ten minutes pain in the joint, but continued to work. Next day visited a physician, who recommended something to rub in, and told the patient to return in fourteen days. Flexion causes no pain. Extension slightly painful and associated with crepitus. No swelling. Patient worked fourteen days without much pain, at the end of which time there was some swelling about the radial side of the elbow. February 12, 1889, left elbow painful, in dorsoradial region slight swelling, skin slightly reddened. Local temperature slightly increased; active flexion and extension good, but some limited. Flexion to 55 degrees. Extension to 135 degrees. Supination one-half normal. Pronation normal. Internal epicondyle prominent. Valgus angle 165 degrees. Epicondyle, olecranon, and head of radius, in normal relation. Head of radius rotates. On dorsum at seat of swelling between ulna and radius a movable body, size of a hazelnut can be felt. Soft crepitus on motion. Physical examination of patient otherwise negative.

Operation shows piece representing the surface of the rotula displaced to the outer side of olecranon in the line of the joint behind head of the radius (Fig. 9).

Kocher's case 2: Male, 19 years old. Admitted to hospital November 13, 1890. Since 12 years old, pain in various joints, with change of weather, attacks last 1 to 3 days, pain worse when member quiet; 14 days ago carried heavy weight to top of house. In the act of laying the weight down, he extended his left arm and felt a sharp pain between the olecranon and external condyle. Pain ceased when act of extending with weight was over. At the moment of extension patient heard a snap in the joint.

From now on could flex, but not extend his arm. Forced extension caused pain beyond a check point. Extension only possible by pressing upon a hard nodule found between olecranon and external epicondyle, which slipped back into joint with a sharp pain. The arm could now be extended and flexed without pain, but the same obstruction and difficulty arose with the next following extension.

During last days has not been able to find movable piece at times; and, when found, he could not push it back into the joint. Extension became more painful, so that he kept his arm slightly flexed.

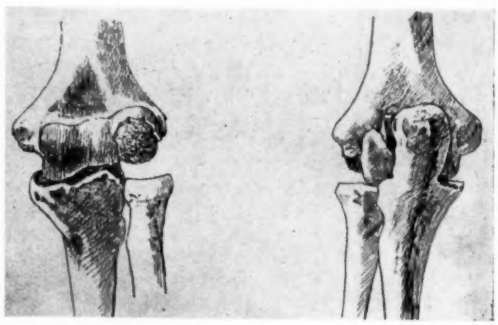

Fig. 9. Kocher's case No. 1. *a*. Joint seen from in front with a rotula devoid of cartilage. *b*. Joint seen from behind with fragment to outer side of olecranon.

November 14, 1890, with both arms extended and forearm prone, the left is seen to be slightly flexed, otherwise no difference except that the anterior half of the depression to outer side of olecranon is filled up. This swelling is hard, slightly tender on pressure, the pain is increased if the arm is flexed and extended at the same time. Crepitus can be felt at this time. All motion good, except extension — which is limited by some obstruction in the joint and by pain. Maximum extension 173 degrees. Pronation and supination normal. General status, moderate goitre, left-sided cubital gland, otherwise negative.

November 28, 1890, operation, ether, chloroform. Incision over the palpable free body just behind margin of external condyle. On opening the joint a piece of cartilage presents, which comes from the external condyle. The piece about the size of a 5-cent coin shows irregularities and the cartilage in the vicinity shows a tab-like outgrowth, which is removed; wound washed with sterile water; suture (Fig. 10).

Kocher's case 3: Male, 17. History, May 21, 1891. In March, i. e., about two months previous, was pressed up against a wall by a horse, the right elbow being on the wall, the vola of the hand on the horse, i. e., the forearm at right angles to the wall and horse. Appreciated a snap in the elbow and great pain. For fourteen days could not work with the arm, but could bend the elbow, no great pain. No swelling, but slight ecchymosis after a few days, occasionally on flexing elbow, some pain. With almost every attempt at flexion patient claims to have noticed a prominent piece of bone on the outer side of the elbow, which he could push back into the joint.

May 22, 1891, extension of right elbow limited to 165 degrees, on extension, valgus angle, of left arm 175 degrees, of right 165 degrees.

Right elbow shows both epicondyles, olecranon, and head of radius in normal position. Between external epicondyle, the head of radius, and the outer margin of the olecranon, there is a depression deeper than on the other side, and a small piece of the external condyle of the humerus seems to be missing.

On flexing the elbow, a small body protrudes behind the head of the radius, which sometimes goes back of its own accord, but must, as a rule, be pushed back into the joint to make extension possible. On pressure, this protuberance disappears into the joint. If the body has not been pushed into the joint and an attempt to extend is then made, the patient experiences much pain.

May 25, 1891, active and passive extension causes a body to become palpable and visible beneath the external condyle, and between this and the posterior upper margin of the head of the radius the dimensions are about 2 cm. by 7–8 mm.

The body becomes jammed with each extension, limiting their motion to 135 degrees, beyond which there is pain. The body can be made to disappear beneath the margin of the external condyle behind the head of the radius. If the forearm is in extreme pronation, the body is harder to push back than with extreme supination. Reposition is associated with soft crepitus. One has the impression that the distance between the head of radius and external condyle is less on the right side than on the left. No lateral motion demonstrated because complete extension impossible. No disturbance of pronation and supination. Extension painful only as seat of body when jammed. No effusion into joint,no joint crepitus on motion. When flexed, the head of radius seems more external anterior and upward than on the other side.

May 26, 1891. Patient cannot extend right arm. Flexion good. Patient extends to 135 degrees, catches there, makes a slight lateral motion and extends to 165.

If pieces of olecranon were broken off, this would be pulled up by triceps and could not become dangerous. Breaking of coronoid improbable, as patient has good flexion.

Might be a piece of head of radius, and, if this has occurred, rotation would have been more interfered with. Good flexion attracts attention, and comes, therefore, to the conclusion that, with the external contour of the joint preserved, a piece of the articular surface of the external condyle must be broken off.

Operation, May 26, 1891. Chloroform, ether. Esmarch bandage. Foreign body made prominent just above head of radius by flexing and pronating the forearm. Kept in this position by fixing the arm. Longitudinal incision, capsule opened and body (Fig. 11) which is covered with cartilage and attached by a very fine strand to the interior of the joint. Strand cut, body removed. On pulling the wound apart, head of radius can be seen intact, and the seat of fracture on external condyle. Two interrupted stitches in capsule. Vertical suspension of arm.

Kocher's case 4: History, June 6, 1892. Male, 14 years of age. Two years ago, without any known etiology, patient noticed disturbances of the function of the right elbow. On flexing the forearm to a certain point, marked pain was produced. Extension, also, had a catch, after surmounting which complete extension became possible. Rotation and supination normal. No redness or swelling, no joint crepitus, no other joint involved.

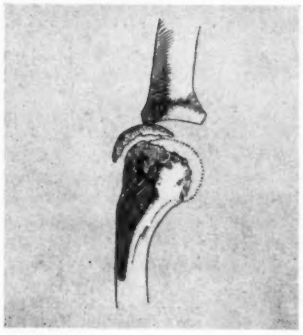

Fig. 10.

Fig. 11.

Fig. 12.

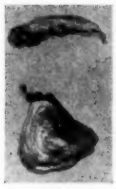

Fig. 13.

Fig. 10. Kocher's case No. 2. Shows defect of rotula and position of fragment in the joint.
Fig. 11. Kocher's case No. 3. *a*. From the side. *b*. From the fracture surface, split off piece of rotula.
Fig. 12. Illustrations from Kocher. Split off piece of condylus externus humeri in fractura rotulæ partialis. Natural size *b* shows small amount of cancellous bone attached. No reference in case report.
Fig. 13. Lorenz' case No. 2. Piece of cartilage removed.

At times motion in the right elbow has been free and painless. When quiet the joint has never been painful. Change in weather increased pain, hence inunctions; without relief. Up to spring of this year fulfilled his duties. In the early days of this May, while lifting a wheelbarrow, had sharp pain in the right elbow and appreciated a cracking noise. The pain ceased immediately, but patient could not extend arm, whereas flexion was less interfered with. No swelling or discoloration. Physicians made a diagnosis of fracture and ordered inunctions.

In eight days joint swelled, limiting motion. Swelling wore down spontaneously. Limitation of extension brings the boy to the hospital.

June 8, 1892, active extension 145 degrees; forced extension beyond this causes much pain. Flexion active, 50 degrees.

Passive extension 150 degrees, passive flexion to 45 degrees. If joint moved rapidly, distinct grating felt. No pain. No thickening of capsule, no reddening of skin. Condyles of humerus seem thickened, and on external condyle a spot tender to pressure. Between head of radius and ulna a small, easily moved, foreign body, half as large as a hazelnut, the surface of which seems hemispherical. Foreign body moves with arm, in extension becoming fixed, in flexion disappearing entirely. In middle position the body is easily moved.

Kocher thinks that proliferating arthritis preceded the accident.

Operation: Esmarch bandage, skin incision corresponds to middle section of Kocher's excision incision. Capsule opened along anterior margin of M. anconæus, the foreign body presses into the capsule incision, is seized and removed. This fragment corresponds to the top of the rotula, and is attached by a thread of periosteum to the external condyle. The rotula seems flat and rough. Continuous suture of capsule and skin, no drainage.

June 25, 1892. Stitches out, p. primam union, no local or general reaction.

June 30, 1892. Discharged; good, active motion in joint, motions all normal (Fig. 12).

Lorenz's case 1: Male, 22. To hospital, January 19, 1904. The day previous, while striking heavy iron rod on anvil, perceived pain in elbow. He bent the elbow and then extended. Extension limited and an abnormal prominence discovered in the elbow. Has always had some limitation of extension in both arms, but no discomfort.

Right elbow flexed to 90 degrees, active flexion normal. Pronation and supination normal. Extension to 100 degrees. Motion within this radius normal. Below external condyle and close to this a flat swelling about the size of a 50-cent piece. Depression at either side of the olecranon preserved. No effusion into joint. Epicondyles normal. Head of radius very large, but left one the same. No tenderness on pressure.

In the center of the swelling is a hard body slightly movable from side to side, which become less palpable on pressure, even to almost disap-

Fig. 14. Showing appearance of arm in Kocher-Lorenz type. 1. Abnormal swelling. 2, Head of radius. 3. External condyle.

pearing. If the joint be flexed and extended, the foreign body reappears immediately. If one palpates the flexed elbow, there is found that in the region of the articular surface of the external condyle there is a loss of substance, the region being also tender to pressure. Passive extension, unless with force, is not possible. There is no pain or spasm in biceps or brachialis, extension being limited mechanically because of the impacted body.

X-ray plate, with arm at 100 degrees extension and slightly rotated out. Irregularity of rotula shadow and also shadow indicating the piece of cartilage behind internal condyle (not well, marked in reproduction).

Left elbow can be extended 165 degrees only. Operation, January 20, 1904. 5 cm. incision over the prominence. Division of anconeous fibers, opening of joint. Slight amount of blood-tinged synovia escapes. The split-off piece of cartilage easily seen and extracted, which turns out to be the cartilagenous covering of the rotula without any bone. In front it is thicker with few fibers of capsule adherent. Spongeosa of capitulum is exposed. After removal, extension possible to over 160. Muscle suture, skin suture. No stiff retention bandage.

January 27, discharged; per primam union. Can extend passively to over 150 degrees, and in a few days was able to extend to over 160; as good as ever.

Lorenz's case 2: Male, aged 20, April 26, 1905. While striking with a heavy hammer, felt sudden pain in right elbow and had to quit work. The forearm could be flexed, but not extended.

Examination: Right forearm flexed to about 135 degrees. Posterior side between olecranon and external condyle and head of radius there is a flat prominence about the size of a quarter, covered with normal skin. In the center of this is a firm, hard body. No other swelling; no fluid in joint; flexion, pronation, and supination active and passive; normal active extension to about 150 degrees. This patient complains of pain. Any attempt at passive extension is met with resistance.

Epicondyles, olecranon, head of radius in normal relation to each other and not sensitive to pressure.

The hard cartilage-like body seems to protrude from the cleft between head of radius and external condyle, presents a sharp angle and seems to be concave downwards. Pressure on the body is sensitive and causes the prominence to disappear, after which extension is easier. The next attempt at extension following flexion causes the prominence to reappear, associated with the same interference with motion. Soft crepitus can be felt on motion with finger on the foreign body. If the external condyle is examined with the elbow flexed, the region of the articular surface is tender and seems defective.

X-ray plate shows beneath the internal condyle a faint shadow extending beyond the normal contour of the rotula (Reproduction not satisfactory).

April 27, 1905: 5 cm. incision over the swelling division of anconeous fibers and capsule; slight amount 5 c.c., of blood-stained synovia escapes. The piece of cartilage representing almost the entire covering of the capitata is displaced back and can be easily seized. It is adherent by a fine strand to the lateral part of the capsule. The strand is divided, the cartilage removed. Two small pieces of spongeosa are attached (Fig. 13). The spongeosa of the capitata is bare. A few muscle sutures — skin suture.

Arm bandaged flexed. May 3, per primam union. Active motion, except for extreme flexion, and extension free and painless.

Fig. 14. May 10th: Complete restoration of function. Discharged well.

Even a cursory study of these reports demonstrates beyond all question that there are two distinct types of fracture of the eminentia capitata, a fact already pointed out by Lorenz. The first group contains those of Hahn, Steinthal, Wright,

Cotton, Stimson, Stebbins, and Flint; the second group those of Kocher and Lorenz. Lorenz would call the former fractura capituli humeri totalis; the latter factura capituli humeri partialis. Although crediting Lorenz with the service of first calling attention to the existence of the two types of fracture of the eminentia capitata, I am opposed to applying distinctive names to the varieties — first, because it supports the ever growing tendency to confuse by dignifying with separate title each individual variation of a recognized species; and, again and chiefly, because the names applied by Lorenz do not accurately fit the clinical findings; as is undisputably brought out by Stimson's second and third cases, which are certainly not partialis in Lorenz's sense of the word, but partialis in that a large part of the spongeosa of the eminentia is split off with the cartilage, a partial fracture, but of the Hahn-Steinthal variety.

If only the two extremes were considered, evulsion of the cartilage on the one hand, and complete separation of the capitata on the other, the appellation suggested by Lorenz would be appropriate. There are, however, the intervening types; and, although the clinical picture of the Hahn-Steinthal variety is quite distinct from the Kocher-Lorenz variety, I am unable to find a term which would apply to the intervening varieties. Kocher's description of the fractura capituli, represented by his cases, and qualified as an evulsion of the cartilage unto which might adhere a small amount of spongeosa, is, to my mind, sufficiently distinctive of the variety, leaving the term fracture of the capitulum humeri for the remaining varieties whether partial or complete.

The difficulty in obtaining reliable data from patients regarding the mechanism of the injury, is well known to those who are in the habit of cross-examining an individual with reference to the value of his story.

In this small series of cases, the positive statements on record will be assumed to represent facts, for as such they must be considered, until a greater number of more carefully recorded observations shall prove the existing errors or modify the conclusions arrived at.

GROUP I

Hahn, Wright, Steinthal, Stimson, Cotton, Stebbins, Flint, and Wims (reference to case, no record).

Of the nine cases of which I am able to obtain data, six were males, three females, the ages varying from 12 to 63; females 24 to 63, males 12 to 40. In only two of the nine cases did the injury occur before the age at which the epiphyses are firmly attached to the diaphyses.

Nature of the injury: In four cases the right elbow was injured; in two the left, and in three the side affected is not known. In seven of the nine cases a definite statement is made regarding the nature of the violence, in two this is unknown.

In five cases there was a fall or a blow upon the flexed elbow. In one case (Stebbins) the injury was produced by indirect violence, a fall upon the pronated, extended forearm,

It is safe to state that the majority of the cases are produced by direct violence upon the elbow, and, that in most instances where it has been possible to ascertain the position of the arm at the same time, the elbow was said to be flexed.

The injury is uncommon, as proven by the number of cases observed even in these days when the clinical diagnosis is based largely upon the ability to read a radiograph rather than upon the skilfully made and correctly interpreted physical examination.

In none of the cases in this group is there any suggestion of previous pathological condition of the elbow.

Of signs and symptoms at the time of injury, pain, swelling, and limitation of motion are the most constant. Crepitus beneath the external condyle is mentioned in Hahn and Stebbins' cases only, although this sign must have been present in other cases as well. In the cases where the fragment has been rotated forward and upward sufficiently to be in front of the head of the radius, the local reaction has been very great; whereas, in those cases (Stimson's) where the fragment was displaced backward or only slightly forward, the local reaction was slight. Ecchymosis may appear at the end of the second day. The functional disability is great — again excepting the two cases of Stimson's where the displacement was back or slightly forward and upward. Where the swelling permitted, the bony landmarks were found to be in normal condition and relationship. A movable hard mass may be felt in front in the outer side of the bend of the elbow.

Stebbins observed that on flexion the head of the radius came to lie behind the fragment, whereas in extension, the fragment seemed to drop back into its normal position. Stimson, who also examined this case, made the same observation.[1]

On late examination, the clinical picture is quite characteristic for all cases where the fragment is rotated forward and upward by about 90 degrees. The forearm is flexed so as to be at right angles to the humerus. This position on late examination depends, of course, somewhat on the treatment to which the arm has been subjected. In Stein-

[1] See Radiographs.

thal's case the arm could not be flexed beyond 135 degrees. The limitation of motion varies from almost complete anchylosis, i. e., only 5 degrees, passive motion, to about 40 degrees. Even this small amount may be painful. Pronation and supination are generally very little interfered with, and may be normal. It is uncommon to have such interference with rotation as was present in Cotton's case. Flexion is limited by firm, bony resistance, not painful. Extension limited by elastic resistance is apt to be painful, if forced even slightly. The radiograph shows a fragment from the lower end of the humerus turned forward by about 90 degrees, the almost straight, or slightly concave fracture surface articulating with the margin of the head of the radius. A convex surface projects into the joint anteriorly, and a gap above the head of the radius shows where the fragment came from. There is a moderate amount of thickening about the elbow, most marked in front and to the outer side of the external condyle. In cases which are several months old, there may be some valgus deformity. Stebbins noticed slight valgus at the time of injury, the arms being held in similar position. The bony landmarks are normal except for the depression beneath the external condyle. In the bend of the elbow is a firm, bony prominence, which does not rotate with the radius and may or may not be movable on the humerus. Crepitus may be obtained, in some instances, by rotating the radius or by moving the detached fragment upon the humerus. This clinical picture of the late examination applies, with moderate variations, to the cases reported by Hahn, Wright, Steinthal, Cotton, and Flint. Stebbins' case was recognized immediately. Stimson's first case cannot be made use of with reference to symptomatology, because of the compound character of the injury.

Stimson's second case, and his third unreported case, form a separate and most important group. In both cases the exact details of the accident were unknown. In both of these cases, the immediate local reaction was slight; in both the functional disability was much less than in the type with extreme anterior displacement of the fragment. In both there was a partial fracture of the capitulum, and in both the displacement was slight, once backward, once forward and upward.

Diagnosis: The differential points of interest have been enumerated by Hahn, and, with the exceptions necessary because of the conditions found in Stimson's cases, Hahn's observations apply unchanged as signs and symptoms to be expected, even though they are not all of differential importance. Hahn enumerates as follows:

1. Both condyles, olecranon and coronoid in normal position and not separated from the shafts.

2. Passive flexion and extension not completely obliterated; pronation and supination normal.

Later observations have shown that pronation and supination, although usually little limited, may occasionally, as in Cotton's case, be considerably interfered with.

3. In front of the external condyle will be observed a rounded prominence, found on pronation and supination not to belong to the radius. This prominence can be made to disappear on extension and reappear on flexion, in certain cases where the fragment is freely movable (Stebbins).

In certain cases of partial fracture, such as Stimson's second, no prominence will be found in front.

4. Capitellum radii found behind the prominence.

Here again the exception above mentioned applies.

5. During pronation and supination, crepitus is felt with the finger on the abnormal prominence.

Although not noted in the majority of the cases, this must be true if examined early. In the older cases where the fragment has become fixed, or has found a new facet on the fracture surface for articulation with the head of the radius, crepitus may be absent. When the fragment is loose, crepitus may be elicited even in old cases, as illustrated by Cotton's record.

A radiograph is most valuable for the purpose of diagnosis, but even with this aid errors may arise, as shown by Steinthal's case.

In the absence of a radiograph, the break has usually been confounded with injury to the external condyle, neck of the radius, or head of the radius.

The displaced fragment of an external condyle, being partly outside the capsule, can be seized. There are symptoms referable to the injured diaphysis, and the landmarks around the external condyle are disturbed.

The displaced fragment of the head of the radius, or the displaced head, might as such be confounded, but examination of the upper end of the radius, of the lower portion of the external condyle behind, and the differing points of tenderness may enable one to avoid error. Again, in cases of fracture of the head or neck of the radius, there is not often the same degree of interference with flexion and extension. It may be easy to ascertain that a fracture of the radius does not exist, but may be possible to arrive at a correct diagnosis of fracture of the capitulum only by excluding other breaks. It is the absence of distinctive signs, rather than the presence of any one sign or symp-

tom, which attracts attention. The chief points are: The nature of the injury; the great degree of disability after marked local reaction; the normal condition of bony landmarks; and the presence of a bony mass in the bend of the flexed elbow to the outer side. Given these signs and symptoms and having excluded the head and neck of the radius, as well as the external condyle in toto, one is justified in concluding that the capitulum has been injured.

In the type of break described in Stimson's cases of partial injury, I do not believe that a correct diagnosis at the time of injury can be made, based on positive findings, without the aid of a radiograph; and it is only a surgeon's accumulated clinical experience which would lead him to suspect an injury of the capitulum, considering the slight symptoms occurring in the partial breaks.

In the older cases the interference with function, with landmarks apparently normal, will arouse suspicion and cause us to seek the corroborative aid of a radiograph.

Treatment: Up to the present time, there is no case record which shows that the fragment can be reduced sufficiently to give good ultimate function if displaced forward, so as to be in front of the head of the radius. Even if reducible, it is doubtful whether the result would be satisfactory. In two of Stimson's cases the displacement was slight, once backward (2d case), once anterior and upward (3d) case, and in both there was great interference with motion.

The reports, up to the present time, indicate that nothing is to be hoped from non-operative care. The results are uniformly bad, the interference with the function of the elbow being very great.

Stebbins' case is unique, and if successful, will disprove the above assertions based on the accumulated experience to date. Stebbins was able in extension to replace the fragment, and, therefore, treated the arm in this position—a procedure perfectly justified, considering the findings in his case. It will be instructive to learn whether union takes place in such a position as to permit of free flexion. If such should be the case, it is quite evident that a viable, movable fragment should be replaced by extending the arm, and this position maintained until union has occurred. The success of Stebbins' case would be a valuable contribution.[1]

Of the nine reported cases, six were operated. In two of these, one of Stimson's, and Wright's case, partial and complete resection were done, respectively—in the former instance, because of infection of the compound injury; in the second, because Wright believed secondary inflammatory changes to have developed in the injured joint.

There remain four operated cases where the final outcome was known.

Steinthal's case, Stimson's two cases, Flint's one case.

In Steinthal's case before operation, the amount of motion was 15 degrees; after operation, more than 70 degrees, a gain of 55. In Stimson's second and third cases the result was satisfactory, although the exact data are not given; and in my case, the amount of motion before operation was 5 degrees, after operation 115 degrees, a gain of 110 degrees. The evidence at hand, then, is distinctly for early surgical interference and removal of the irreducible and non-viable fragment interfering with motion. Stimson in his second case of fracture of the lower two-thirds of the capitulum, found the fragment attached posteriorly, and sewed it into place with few sutures. This case is unique, again, in respect to treatment as well as line of fracture, and would justify the conclusion that, if a fragment could be reflexed and were viable, it had better be sewn in place, the result having been favorable in this case of Stimson's.

In any event, the fracture should be cut down upon, inasmuch as a very slight amount of displacement will greatly affect the motion of the elbow.

Operative procedure: Method of approach. Steinthal used an external incision 10 cm. long, Wright an incision over the head of the radius, Stimson an external incision (personal communication), and the author Kocher's postero external incision. To obtain the maximum functional result from an operation about the elbow, it is it is imperative to effect a minimum amount of disturbance at the time of operation, and leave the joint structures in as nearly a normal state as is possible. Although the anterior incision to the inner side of the supinator longus, immediately over the displaced fragment, is a tempting route to follow, I am opposed to this, because of the resulting scar exactly in the bend of the elbow, which materially impedes the progress of convalescence and prevents, in many cases, the attainment of complete extension for a long time. I have observed that scars in this region, following operations for other injuries, have this disadvantageous effect. Another objection is the fact that, should it be found possible to reduce the fragment displaced anteriorly, it would be impossible to place retention sutures through this wound.

In cases, such at Stimson's second and third, where the displacement was back or very slightly

[1] Dr. Stebbins informs me under date of March 24, 1908, i.e., three months after injury, that active motion is checked at about 90° flexion with some limitation of extension. Propination and supination are normal. Under ether, flexion can be forced to about normal.

forward, this anterior incision would, of course, be useless except for removal of the fragment. I am, therefore, in favor of Kocher's postero external incision, and call attention here to the details, because of the importance of producing a minimum amount of trauma, and of being able to accurately replace strictures. To avoid repetition, I would refer to the details of the operation above reported in connection with my cases.

Steinthal, besides removing the fragment, resected the head of the radius, and to prevent bony anchylosis the wound was packed with gauze.

In my case, where the pathological condition was identical, the head of the radius was not resected. The final outcome demonstrates that the head of the radius need not be sacrificed.

The position in which the arm is placed after operation is important. I believe that acute flexion is best because it is easier to regain extreme extension than extreme flexion; and, in my cases, the great gain of motion is, in my opinion, due to the fact that the arm was put up after operation at an acute angle, and that massage and passive motion were started early. I prefer to use an external moulded plaster splint held at an acute angle by bandages, with the dressing retained in such a way as to avoid any pressure whatsoever in the bend of the elbow, only one layer of gauze being placed here toprevent maceration of the skin.

Passive motion should be commenced at the end of the 7th day, massage as soon as the wound has healed. During the first three weeks, it is best to replace the elbow as an acute angle after each treatment—a rule which applies to most operative fracture work in the region of the lower end of the humerus.

As soon as it is apparent that the angle of flexion shows no tendency to become less after passive motion, then the arm may be allowed to hang and active motion resorted to.

Prognosis: The outcome, without operation, is unfavorable. After operation there is great improvement. This applies to simple cases, and not to such as are complicated by some intercurrent condition.

There may be some valgus deformity, but the strength of the arm is not greatly injured.

After six weeks the patient can resume work.

Description of fragment: In Hahn's, Steinthal's, Wright's, Stimson's, and my own case, the fragment could be examined.

It is noticeable that my case has a very narrow margin of trochlea. It occurred to me that, in the cases where there was direct violence upon a flexed elbow, the fragment might be broken off from without inwards, and in that way the narrow rim of trochlea might be explained—a theory which I cannot reinforce with facts.

Stimson's second case is important in that only about two-thirds of the capitulum is broken off, and in Stimson's third case, the specimen of which I have seen, the fragment was about half the eminentia capitata, i. e., they are both partial fractures of the capitulum.

In my case, the head of the radius had worn a beautifully smooth facet on the fracture surface of the fragment, a condition which must have been present in the other cases where the fragment was displaced forward to the same degree.

Steinthal and Wright found granulations in the joint. In my case, granulation tissue filled the gap above the head of the radius. Wright speaks of these granulations as having been "pulpy, strumous," and found evidence of destruction of the fragment. He, therefore, deemed it wise to excise the elbow. The insufficient data do not enable any expression of opinion on this subject. The granulations in my cases seemed no more than to be expected in an injury of this character. Hahn's specimen showed secondary osseous deposits and ossification of ligaments and muscle insertions about the elbow—conditions which we see frequently in the chronic types of arthritis, whether the result of trauma or not.

GROUP II

Kocher and Lorenz. Six cases. The characteristics of this variety of fracture of the eminentia capitata have been well brought out by Lorenz in connection with his two cases. I review the points brought out by Kocher and Lorenz for the purpose of comparison with the cases in Group I.

Nature of injury: In four cases the fracture was produced by indirect violence, fall on extended hand, caught forearm, between horse and wall, pressure in long axis of forearm. Twice while striking with heavy implement. In two cases reported by Kocher, the injury is said to have occurred in the act of lifting with forearm extended. Kocher advances the theory that the break occurred because of the tense anterior portion of the capsule pressing back directly on the capitulum and prying the cartilage off. Lorenz objects to this theory on the ground that such a degree of tension could be produced only by overextension, which could not occur during the act of straight lifting.

In my opinion, Lorenz's objection is valid. Whatever the mechanism of these two extension cases, Kocher's theory is not a satisfactory explanation, for anatomical reasons.

Kocher states that the etiology corresponds to that of fracture of the external condyle.

This seems to be true of the cases where the force is transmitted through the radius to the eminentia capitata, but is not true of the variety occurring with the arm extended. Fracture of the external condyle can occur by over-extension, but as yet there are no data which prove that the Kocher-Lorenz type of injury has occurred in an over-extended arm. Kocher also advances the theory that the anterior attachment of the capsule tears off horizonitally, and that the adjoining cartilagenous covering of the eminentia is torn off, too. The theory might apply, in an over-extended arm, even though the bulk of clinical evidence shows that over-extension in people be-between 14 and 22 years of age, results in a fracture involving the humerus at or above the attachment of the capsule.

Up to the present time, the facts do not permit of an explanation of the mechanism of all the cases, but it is safe to say that the majority of the injuries are due to indirect violence.

It is interesting to note in this connection, that Lorenz was unable to produce the injury on the cadaver.

Kocher states that the injury is not uncommon. This seems to be true for the period between February 8, 1889, and June 6, 1892, during which era there were observed by Kocher in Berne, four cases. Since that time fracture literature contains no reports of this injury for sixteen years, i. e., up to the announcement of the two cases observed by Lorenz in 1904 and 1905. Unless an unprecedented modesty or reluctance on the part of observers explains the dearth of reports, we are forced to conclude that the injury is still somewhat uncommon. Whether previous pathological changes are of etiological importance cannot be decided from the reports. It is, however, important to note that in three of the six cases, there was some previous affliction of the joints.

In one of Kocher's cases, the boy of 19 had had during the previous seven years, at intervals, attacks of pain affecting various joints, coming on with a change in weather and lasting 1 to 3 days. The pain was worse when the member was quiet. In this case irregularities in the cartilage were found, also a tablike outgrowth in the joint. In another case, reported also by Kocher, a boy 14 years of age had noticed two years previous to his injury, disturbances in function of his elbow. No known cause could be attributed. On flexing the forearm to a certain point, marked pain was produced. Extension, also, had a catch, after surmounting which complete extension became possible. There were no other regular symptoms. Change in weather increased the symptoms, and the joint never painful when member was quiet.

In one of Lorenz's cases there had been bilateral limitation of extension, amounting to about 15 degrees. This had always existed, and caused no disturbance.

Of symptoms and signs at the time of injury there are recorded sharp, transient pain, a "snap" in the joint; limitation of extension because of obstruction and pain; the presence of a hard mass projecting from the joint between the olecranon, head of radius and external condyle, the ability to complete extension after pressing the foreign body into the joint. Flexion not interfered with as a rule. The foreign body reappearing on the first attempt at extension following flexion. Functional disability slight; very little, if any, swelling of joint.

In Kocher's third case the signs and symptoms appearing immediately were more pronounced, disability being great and pain being appreciated on flexion. Flexion also caused the foreign body to appear at the outer side of the elbow.

The late examinations show little change in the clinical picture. Swelling was present in the region at the side of the olecranon between the head of the radius and external condyle. This swelling is usually about the size of a quarter and in the center contains a firm cartilage-like fragment. Valgus deformity existed in two of Kocher's cases, a deepening of the fossa at the outer side of the olecranon may also be present associated with tenderness to pressure in this region. Flexion was found to be little interfered with, but extension was limited considerably, even at 100 degrees. Passive extension was possible to a slightly greater extent, but was accompanied by pain. Pronation and supination remained normal in most of the cases, in one of Kocher's only was supination limited to one-half the normal amount. In all of the cases extension was interfered with by the interposition of the fragment, and could be carried to normal by crowding this foreign piece back into the joint, a procedure usually associated with pain.

In all of the cases but one (Kocher's 3rd) extension brought the fragment into prominence. In this case of Kocher's the fragment appeared during flexion. Soft crepitus can usually be felt by pressing on the fragment, and, in some cases, by simply moving the elbow.

Kocher, in the résumé of his cases, states that the arm is held in incomplete extension. This is apparently the usual position assumed, but in

Kocher's second case extension became more and more painful, especially when the fragment became impacted so that the patient held his arm flexed. The slight abduction of the forearm referred to by Kocher and doubted by Lorenz, does not seem to be present in all cases. The olecranon is less prominent, being impinged upon by the swelling to the outer side. This remark of Kocher's cannot apply to the third case of his series, where a depression was found at the side of the olecranon, between this and the head of the radius and external condyle. The head of the radius appears larger because of the diminution of the size of the rotula. Bony landmarks are easily examined, because there is no effusion into the joint.

All motion free except extension and supination. If these motions are forced the head of the radius is crowded up against the fragment and causes pain. This assertion of Kocher's with reference to supination is hard to reconcile with the statements found not only in his case records, but also in those of Lorenz. It is specifically stated in the majority of the cases that pronation and supination were normal. In one case only, i. e., Kocher's first case, is there any marked limitation of supination.

Extension may be suddenly checked and suddenly freed. If extension is forced after being checked, pain is produced.

Kocher states that the diagnosis depends on the sudden checking of extension and supination, associated with pain, and on the presence of a foreign body between the head of the radius and external condyle, not felt with the arm flexed, as in this position the joint allows the fragment to slip into the articular cleft. On extension the fragment reappears above and behind the head of the radius and on pressure the fragment may be forced into the joint or felt to disappear on flexion. Pressure on the fragment causes discomfort. The general symptoms are those of joint mouse with special signs referable to position, angle or valgus (questioned by Lorenz) and limitation of motion. Kocher also warns against confounding with a break of the head of the radius.

The treatment has been operative, consisting in removal of the fragment, the result being uniformly good.

The fragment found in both Kocher's and Lorenz's cases has consisted of cartilage with only a slight amount of spongeosa attached to certain of the larger fragments. In several instances a strand of tissue still bound the fragment loosely to the humerus in front.

In reviewing the facts relating to both groups briefly, it is safe to say that the eminentia capitata may be broken by direct or indirect violence. If direct violence be the cause, the line of fracture is apt to traverse the spongeosa, chipping off part or all of the eminentia capitata, with or without a narrow margin of adjoining trochlea. If indirect violence came into play, there is apt to occur an evulsion of the cartilage without damage to the spongeosa, except for a few small particles adhering to the fragment.

The symptoms and signs of the cartilage evulsion cases and of the spongeosa injuries without much displacement are relatively slight. The group of symptoms and signs accompanying the cartilage evulsion cases is distinctive. The symptoms and signs of the breaks involving but a portion of the spongeosa of the capitulum are not distinctive, but the signs and symptoms associated with complete breaks of the eminentia capitata are again more distinctive,

The diagnosis is difficult: joint mouse cannot be absolutely disproven in the cartilage evulsion cases, and in the variety involving the spongeosa it may be most difficult to eliminate an injury to the head of the radius when no defect can be felt on the radius. The prognosis of all cases with operation is good.

Up to the present time there is no case reported where non-operative treatment has resulted favorably.

Each new case reported brings to light data which tend to complete the clinical picture. It takes but little thought to realize that as yet the accumulated data do not enable a description of the injury, particularly of the variety involving the spongeosa, which adequately covers the subject, and it is to be hoped that those to whom the opportunity does come will not neglect their chance to throw more light upon this most interesting injury of the elbow.

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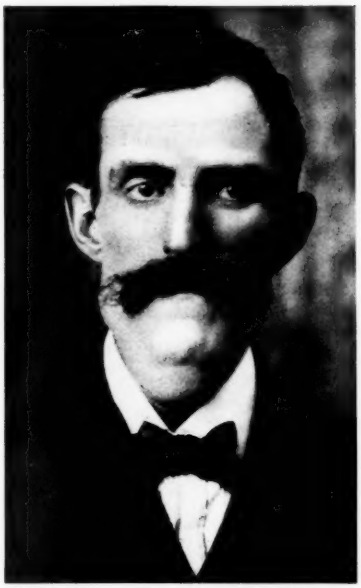
CYST OF THE THYREOGLOSSAL DUCT

By J. F. HULTGEN, M. D., Chicago.

If the thyreoglossal duct or any part of it be be not obliterated after fœtal life, the continual shedding of epithelium and accumulation of sebum from the parietal glands will convert it into a cyst, which by its progress will reach such a size as to come within range of clinical observation (1). According to the location and character of these cysts we may have one or more of the three vagaries of a patulous or persistent thyreoglossal duct: *a* Dermoid of tongue, or lingual dermoid (so-called); *b* median cervical fistula (4), if such a cyst has been opened without extirpation; *c* accessory thyroids. Some of these latter have been included by V. L. Schrager (2) under the collective name of aberrant thyroids. As a rule cysts of the thyreoglossal duct are strictly confined to the median line in the upper or middle or lower portion of the thyreoglossal tract. In my opinion the obliteration of this duct is prevented by the inclusion in its walls of (a) entodermal structure, such as thyroid gland tissue, or of (b) ectodermal tissue such as sebaceous glands. The latter is exemplified by my own case, the former by Dr. J. B. Murphy's case (3). In either variety of cases the lumen of the duct is kept patent by the material secreted from these functionating glands, which, of course, may wake up at any time, but do so particularly at critical periods of life, at puberty for instance, and cause the patient to consult the physician. Thyreoglossal cysts and lateral aberrant thyroids begin to give rise to symptoms at about the same time of life, i.e., puberty or pubescence, but the inconveniences therefrom can be put up with so easily that most of them wait until cosmetic reasons or pressure symptoms compel them to seek relief. Like all embryologic inclusions, these anomalous tumors lie dormant for many years and then exhibit one or more of their characteristics which may be designated as follows:

1. Waking up at certain periods in life to moderate or excessive physiologic activity, resulting in variously constituted and variously styled tumors classified according to their genesis, their location, their morphology, or anatomical characters. They occur most frequently where the primitive embryonic layers mix and fuse to form such organs as are derived from the branchial system or from the urogenital analogues, from the primitive suprarenal bodies to the Müllerian ducts.

2. Their tendency to develop into malignant tumors which (nearly all) have a marked positivity towards bony metastases.



Photograph showing tumor.

The following case of mine is descriptive of the first named tendency of all embryonal remnants, namely, that of cyst formation.

The patient, J. S., laborer, German, 40 years old, consulted me, May 7, 1905, for a marked tumor which he had had for eighteen years. It has been opened under the tongue repeatedly by various physicians in the course of the last eight to ten years, and a creamy, ill-smelling fluid evacuated. The tumor, however, would refill after each operation and keep on growing until it had reached its present size, of which some idea can be obtained by looking at the photograph taken three days before operation, May 9, 1905. The patient's tongue was pushed upward and backward so that upon opening his mouth only its base was visible, while the upper lingual surface was pushed back into the throat. Swallowing was very difficult, nasal regurgitation present at each deglutition act. The patient had to take his wife with him because his own speech was unintelligible. The mouth was gaping, owing to the size of the sublingual tumor, and the flow of saliva was obstructed. Patient morose and irritable. Size of tumor, that of a small child's head. Pressure upon upper trachea with all its symptoms. Otherwise, nothing found on general examination.

Operation May 9, 1905. Chloroform-ether. Vertical inverted T incision in median line of neck. Tumor easily exposed and drained in order to give room for the operator and to relieve the respiratory difficulties of the patient. About one pint of horribly fetid, cream-colored fluid removed, which looked like fluid from a sebaceous cyst. The cyst had the shape of an immense pear and had its stem, i.e., pedicle, under the posterior portion of the tongue. It was adherent only between the foramen cæcum and the center of the hyoid bone, but easily enough clamped and peeled off. It extended below the hyoid bone and was found to lie upon the upper 2-3 tracheal rings, and to have split into two halves the structures making up the floor of the mouth. Thyroid gland present and apparently normal. Operation rather difficult because of the tugging upon the hyoid bone and thyroid cartilage incident to the loosening of the cyst and because of the tongue lying in the throat until the tumor had been removed. Packing of cavity, suturing of platysma and skin; drainage. Œdema of the larynx developed in the afternoon, which, however, passed off within eight to ten hours. Healing of wound within six days. Patient has felt very well ever since. The tongue has regained its normal motility and position.

CONCLUSIONS. This was a case of cyst of a persistent thyreoglossal duct which contained sebaceous material, because some sebaceous ectodermic glands were included in its wall and gave this tumor its rapid growth, large size, and contents. The pedicle was attached to tongue in the exact location of the fœtal foramen cæcum, i.e., the upper end of the thyreoglossal duct. The simplest and yet most descriptive term for these cysts is that of cyst of the thyreoglossal duct, which gives at once the genesis, median location, and clinical properties. If the walls of this embryonic duct contain strands of thyroid tissue, the contents of such a cyst are likely to be goiterous, colloid material, as in Dr. J. B. Murphy's case. If sebaceous gland inclusions are present, the cyst will still be due to the distention of that same duct, with sebaceous material as the only difference. In either case it is the secreting glands that produce the cyst, but it is *their* genesis that determines the contents of that cyst.

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A HEALING INTUSSUSCEPTION IN A CASE OF MULTIPLE POLYPI OF THE INTESTINE[1]

BY CHARLES A. PARKER, M. D., CHICAGO
From the Surgical Clinic of Dr. A. D. Bevan, Rush Medical College, in Affiliation with the University of Chicago

In April, 1907, Professor Bevan operated in the Rush clinic upon a man, 44 years of age, presenting symptoms of chronic intestinal obstruction, and removed from the distal end of the ileum, within a few centimeters of the cæcum, an irreducible intussusception measuring 10 cm. in length and 4 to 5 cm. in diameter. An enteroanastomosis was made and recovery followed.

At the operation a number of pedunculated polypoid bodies, averaging about a centimeter in diameter, were observed in the lumen of the small bowel and several were removed. A larger growth was contained in the intussusception. Sections showed it to belong to the common type of glandular polypi, the intussusception being apparently an incident in the general process of intestinal polyposis.

The patient, a miner, had been perfectly well up to the 14th of the previous November. From this time on he suffered almost continual abdominal pain and vomiting for twenty-one days, when he passed 12 inches of what his physician said was small bowel. Relief followed for a few weeks, but similar symptoms recurred and continued up to the time of the operation. At no time had blood been observed in the stools.

The intussusception. As seen in Fig. 1, the intussusception appears irregular in that not all parts of the proximal gut are invaginated; it looks like an incomplete invagination with the mesenteric border most involved. The free border of the intussusception that is continuous with the free border of the proximal bowel shows no macroscopic evidence of scar formation. In the proximal portion a spherical tumor is seen nearly filling the lumen. The section shown in Fig. 2 fully exposes the structure, showing a section of the tumor mentioned and the intussusceptum. The cut is longitudinal and bisects the specimen, but one lateral half being shown. The intussusceptum maintains

[1] Read before the Chicago Pathological Society, April 13, 1908.

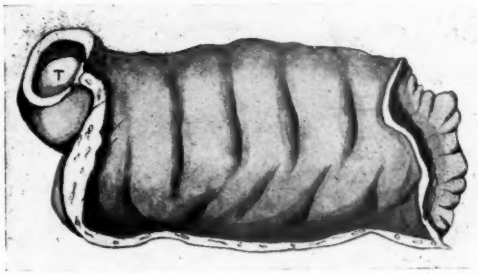

Fig. 1. External view of intussusception. A small tumor, T, is seen in the proximal end. The mesentery is invaginated below, while above the free border is continuous—without invagination—with the free border of the proximal bowel.

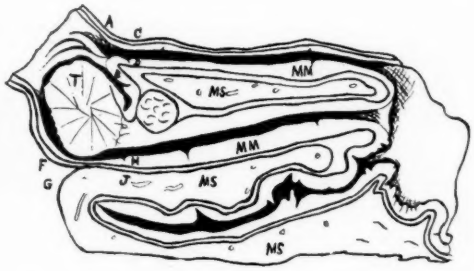

Fig. 2. Longitudinal section of intussusception. A is the free border of the proximal bowel which is directly continuous with C, or the outer cylinder of the intussusception. T is the tumor visible in Fig. 1; just distal to it is the section of a smaller, spherical, submucous tumor about one centimeter in diameter. The heavily shaded portions represent the lumina. MM is mucous membrane; MS, mesentery. The other letters are referred to in the text.

its original lumen, more or less obstructed by the tumor, while at the upper part of the specimen, toward the free border of the bowel, another channel is also continuous from the proximal bowel between the first and second layers of the specimen.

This last channel is peculiar, as ordinarily the lumen here ends abruptly as between the first and second layers in the lower part of the picture. It is most reasonable to presume that originally the parts A B and the parts C D were continuous in the same manner as F H and G J are now. Changes occurred uniting A to C and B to D, with necrosis of the intervening tissue and opening of the accessory lumen. This secondary opening between A and B extends about one-third of the way around the neck of the intussusceptum. A similar change can easily be conceived, if F and G and H and J should unite and the intervening tissue necrose and connect the two adjacent lumina. What has already occurred and what has just been suggested are well-known changes in the course of this affection which sometimes lead to complete detachment of the intussusceptum and spontaneous recovery — an occurrence that in all probability once actually took place in the previous experience of this patient.

The specimen is interesting as showing one of the stages in this process during a second attempt at a natural relief.

Although similar intermediate stages must frequently occur in cases progressing toward recovery, a fruitless search through considerable available literature would indicate that the description and illustration of just such a stage or condition as here presented is by no means common, if it be not rare.

Statistics show that polypi cause 5 per cent of all invaginations, and from their frequency in this case we naturally think of them here as the probable cause. In the specimen, however, the largest tumor is at the proximal end and nearly or quite out of the grasp of the surrounding cylinders which are the main factors in continuing the downward progress. It is in the last portion of the intestine to enter the intussusception, and its relation here is apparently incidental rather than causal. This assumption does not preclude the possibility of similar tumors that have since disappeared playing the leading rôle in its production. The origin of the previous slough of bowel related in the history is not plain. There is no local evidence that it came from the region at present involved. Lesions in other portions of the bowel were not noted at the operation.

The patient left the hospital, June 5, 1907, and in a recent letter says he is in perfect health.

SUBACUTE PERFORATION OF THE STOMACH [1]

With Report of a Case

By MAURICE KAHN, M. D.
Surgeon to St. Vincent's Hospital, Leadville, Colorado

While I feel that the term, subacute perforation, is not accurately descriptive, for the perforation in all cases is acute or sudden, yet inasmuch as the term has gained currency and the condition recognized by it, and moreover, as I am unable to supply a better one, I too shall use the term which others find sufficient.

By subacute perforation is meant a perforation of the stomach wherein nature by some means or another effectually prevents the continuous expression of gastric contents, thereby inhibiting the progressive symptoms characteristic of acute perforation. This may be accomplished by the adhesion of a nearby viscus or the abdominal wall; or by the abundant outpouring of protective lymph; or by a plugging of the opening with herniated mucous membrane, or with a tag of omentum So that subacute perforation applies properly to the condition in or about the aperture at the time the perforation occurs, or subsequent thereto, and not to the perforation itself. As is readily seen, the subacute type is more apt to occur if the stomach is empty so that little material is forced out through the orifice, thus giving nature a more favorable opportunity to circumscribe the outpouring infective material and to prevent its continuance.

In acute perforation, occurring as it usually does shortly after a hearty meal, there is abundant outpouring of stomach contents. Subacute perforation which generally occurs some hours after a meal, the stomach then being commonly empty of food stuff, follows some such exertion as increases the intraabdominal pressure, i.e., lifting, straining, and the like.

It follows, then, that the symptoms are identical with the acute type to the point of localization, which, if it occurs stamps the perforation as subacute; if not, it then remains acute and progressive. Therefore, if the patient is seen very early acute perforation will be the diagnosis, and it is only in those cases where operation for some reason is not promptly performed that the subacute variety is recognized.

Subacute perforation is nearly always secondary to chronic ulcer of the stomach, though it is conceivable that acute ulceration may also rarely result in subacute perforation, though manifestly not common; for the slow advance of an ulcerative process in the hollow viscera predisposes to protective adhesions about the site of threatened perforation, as is often seen about the appendix.

A history of gastric ulcer or "stomach trouble" enduring for months or years is practically always to be obtained. The pain, as a rule, comes on suddenly; is intolerably intense; there is vomiting and often hæmatemesis and retching, great prostration and maybe collapse. Usually the stomach or "sore spot" is more sensitive for a few hours or days prior to rupture. Occasionally a patient may feel almost free from pain for a few hours prior to rupture. This unusual feeling of well-being shortly before rupture may be a factor at times in causing the perforation. To my mind it seems plausible to assume that when a patient, accustomed to suffering, is feeling fairly well and free from pain, he is more prone at this time violently to exert himself, which exertion may be the immediate cause of the perforation. The abdomen is universally tender but greatest tenderness is generally to be found over the site of perforation; and in this region too, though not nearly so well localized, is where the patient complains of the pain. Costal breathing is the type in this disease. The next few hours exhibit a gradual recession of the acute symptoms; the pain subsides; the pulse, which may have been barely perceptible at the wrist, becomes slower and of better quality; vomiting ceases; the hard scaphoid abdomen becomes soft and normal, and the patient has that feeling of comfort which invariably succeeds the cessation of extreme pain. This very cessation of grave symptoms may induce the unwary to revise a correct diagnosis, but if this condition with its history and characteristic symptoms is borne in mind, such error should occur but rarely. Pain in the flanks commonly complained of in acute perforation, due to the gastric contents gravitating to these troughs, is of course not observed in subacute perforation.

Differential diagnosis. Acute, subacute, and hæmorrhagic pancreatitis are characterized by similar symptoms, but the abdomen is distended and fever develops. No history of gastric trouble.

[1] Read before the Lake County Medical Association.

No blood in the vomitus. Later, may have various points of tenderness and pain throughout the abdomen, indicating areas of fat necrosis; and progressive emaciation supervenes.

Pancreatic cyst. Usually epigastric pain for months or years with occasional paroxysm of more severe pain, the so-called cœliac neuralgia (due to pressure on the cœliac plexus), which may be attended with mild collapse and slight epigastric tenderness. But finding the tumor mass will differentiate this from perforation, as will also the milder type of the symptoms. Fat and undigested muscle fibers may be observed in the fæces, and glycosuria may be present.

Pancreatic stone. Colic resembles biliary colic, but the radiating pain is usually to left shoulder and in the left hypochondrium. Glycosuria and stearrhœa may be present, and the characteristic stones may be found in the stools. Jaundice is rarely present.

Cholelithiasis. Tenderness is usually over the gall-bladder. Liver may be enlarged and tender. Jaundice may be present. Pain radiates to right shoulder. Stones may be found in the fæces. No collapse as a rule.

Nephrolithiasis. Pain in back, may radiate to the epigastrium but usually also to groin and testicle or labium. Hæmaturia is generally present and occasionally pyuria. Tenderness over kidney and not over stomach. Usually no collapse.

Gastric crises of tabes may be severe and simulate perforation, but in this disease the radiation of pain is in all directions and would be suggestive and other symptoms of ataxia would be present and easily found if sought. Confusion would not occur if this condition be borne in mind.

Intestinal obstruction and internal hernia. The onset is sudden and the symptoms are similar. Pain is generally about the umbilicus. Obstipation exists in this condition. Abdomen is distended and not usually tender.

Acute dilatation of stomach. Pain may be severe, but vomiting is periodic and characterized by large amounts. Collapse is rarely evident. Abdomen over gastric area is distended. Tenderness is not present in the majority of cases and when present is not marked. Succussion splash is almost always to be elicited. Abdomen is not rigid. Moreover a large percentage of these cases follow operation. The use of the stomach tube, which would differentiate this from many other conditions would not be allowable if perforation were suspected.

Appendicitis would not be confounded with perforation, excepting perhaps very rarely in perforative appendicitis when the symptoms might be similar, but the point of greatest tenderness would be over the appendix region and the symptoms would likely be progressive and distension be present. The history too would be dissimilar from that of perforation.

CASE: Mr. M. Age 29. For 14 years had "stomach trouble" most of the time. From 3 to 5 attacks of vomiting annually, but never hæmatemesis. Was treated from time to time during this period but says ulcer was not one of the diagnoses made. Constant epigastric tenderness for years. Increased pain and tenderness for few days prior to rupture, but during the afternoon of the 7th of Feb., 1907, feeling better than usual, he was employed in throwing baled hay from a sleigh to a store-room which was about three feet higher than the man's head. Later he was pushing the sleigh through the snow when he was taken with sudden, severe, lancinating pain in the abdomen. Being unable to walk, he was carried to a nearby house where he was seen within 30 minutes of the onset, at which time he was writhing in agony and devoutly begging for relief. The drawn, pained expression, the beads of perspiration on face and forehead, the marked collapse with a barely perceptible radial pulse, the extreme epigastric tenderness, the hard, scaphoid abdomen, all bore witness to the man's serious condition. A basin at the side of the couch contained blood-stained vomitus. During the next half hour he vomited twice more. A half grain of morphia hypodermically relieved the pain some and he was removed to the hospital for the purpose of being operated. This he refused to permit, and his consent was not obtained until a week later. During this period he obtained nothing by mouth, having been given the usual rectal diet.

Operation. Feb. 14, 1907. Incision ½ inch to the right of the median line above the umbilicus. Peritoneum injected in this region and very lacerable. The gall-bladder overlay a portion of the distal end of the stomach. The gall-bladder was gently raised and it was remarkable how very slight the adhesions were that held it in this position. This disclosed a perforation of the antrum pylori anteriorily, admitting the end of the little finger. This opening in the stomach was closed with double purse-string sutures. The appendix was also removed. Abdomen was sewed up tight. Recovery was uneventful, excepting for a bothersome singultus for several days following the operation. March 10, 1908: Feels fine. Weight 150 pounds, which is 10 pounds more than he ever weighed prior to the perforation.

ACUTE CHOLECYSTITIS IN THE SECOND WEEK OF TYPHOID FEVER. CHOLECYSTOSTOMY WITH RECOVERY OF PURE CULTURE OF TYPHOID BACILLI FROM CONTENTS OF THE GALL-BLADDER

By J. M. MASON, M. D., Birmingham, Alabama
Gynecologist to St. Vincent's Hospital

The following case of acute cholecystitis occurring in the second week of an attack of typhoid fever, was operated upon by the writer on about the 10th day of the illness, with entire relief of symptoms. No doubt the patient would have made a complete recovery but for the occurrence of a severe pulmonary hæmorrhage due to old tubercular disease, which resulted in his death on the 9th day after operation.

The case is reported partly on account of the infrequency of reports of operations upon the gall-bladder during the course of typhoid fever, but chiefly because I am of the opinion that cases of acute infection of the gall-bladder of sufficient severity to demand operation are, perhaps, of more frequent occurrence than has heretofore been believed.

The profession has long known of the constant presence of typhoid bacilli in the gall-bladders of patients suffering from typhoid fever, and of the frequency of post-typhoid gall-bladder disease and stone formation. Recent contributions, notably those of Thomas (*N. Y. Med. Journal*, April, 1907), and Ashurst (*Amer. Journal of the Med. Sciences*, April, 1908), have drawn attention to acute infections of the gall-bladder during the course of the fever, and to the necessity of subjecting certain of the cases to operation; pericholecystitis, perforation, and general peritonitis having been frequently noted in cases which were left too long without operative intervention.

HISTORY

E. S., white, male, aged 39, went to bed on November 1, 1907, with an illness which proved to be typhoid fever. His previous history was good in all respects except that he had developed pulmonary tuberculosis five years before, and, after prolonged treatment in the West, had been clinically cured for more than a year. I had examined his lungs frequently during the year previous to the development of the typhoid fever, and was never able to detect any areas of consolidation.

Examination at time he was taken sick showed:

Heart normal; lungs free from evidence of tuberculosis or other disease; splenic dullness normal; liver and gall-bladder region free from enlargement or evidence of disease; leukocytes 8,200; urine negative; no malarial organisms found in either fresh or stained blood; abdomen slightly distended, with gurgling in right iliac fossa; temperature 102 3/5; pulse 96.

On November 6th, Widal was positive, and on November 8th, rose spots were present. The day that I first saw him was probably the third day of his illness. For the next three days his condition was not unusual, except that there was, perhaps, more than the usual amount of nervousness.

On November 4th, 5th, and 6th, there was a tendency to nausea, and he vomited once or twice on each of these days. There was no abdominal pain or tenderness and the bowels moved daily from enemata. The urine at this time showed a trace of albumen and a few hyaline and granular casts. On November 7th vomiting was more persistent and he complained of some soreness in the epigastrium. Slight resistence was found in the right upper quadrant, and this

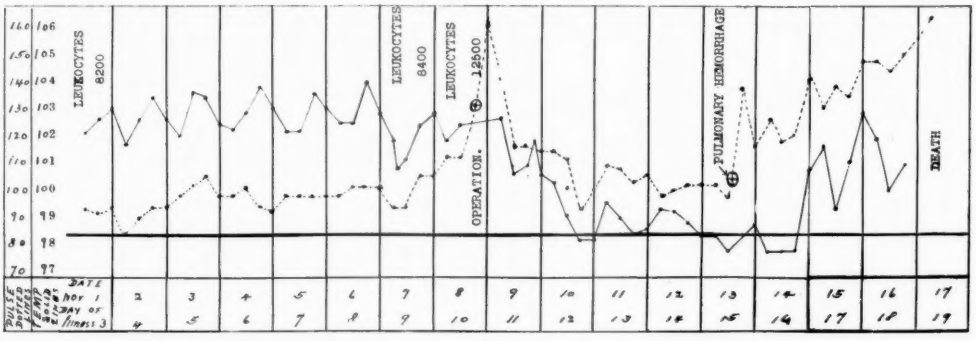

Chart showing pulse and temperature, cholecystostomy on the tenth day of typhoid fever.

region was distinctly tender. We decided that the gall-bladder was inflamed. The leukocyte count on this afternoon was 8,400, and the pulse was 108. The stomach was washed out.

At my morning visit on the 8th, the tenderness and resistence in the right upper quadrant were more marked and a distinct tumor occupied the gall-bladder region. Following the stomach washing on the day before, he did not vomit at all until about 3 P. M. of the 8th, and the temperature remained about as it had been for several days, but the pulse rose to 116. From 3 o'clock on, his condition became rapidly worse, and by 5 P. M. he was vomiting constantly and the pulse had gone to 134 and was increasing in rapidity. A leukocyte count now showed 12,500. After consultation we decided that perforation of the gall-bladder was imminent, and that immediate operation was indicated. This I arranged to do at the residence at once.

The gall-bladder was exposed through an incision in the upper part of the right rectus, and as soon as the peritoneum was opened there was a discharge of bile-stained fluid. Upon sponging this away, the greatly distended gall-bladder presented in the wound. A layer of omentum rested on top of it and was adherent to the fundus, around which a small amount of lymph was noted. The adhesions were separated and the gall-bladder was examined for evidence of perforation, but none was found. The organ was enlarged and tense and its walls were very dark. After sponging away the bile-stained fluid, no more accumulated, so we decided that the pericholecystitis was caused by extension of inflammation through the walls of the intact gall-bladder.

Cholecystostomy was performed, and the gall-bladder was found to be full of dark thick bile. No stones could be detected by the probe or by the finger introduced into the cavity of the gall-bladder. Hypodermoclysis was employed during the opperation, and the patient left the table with a pulse of 164, but of good volume. The next morning the pulse was 116 and the temperature was 100 4/5. There was very little post-anæsthetic vomiting. After the first 48 hours following the operation there was relief of all distressing symptoms. The bowels moved daily; the vomiting ceased and he was able to take nourishment; the urine cleared up and increased in amount; the pulse fell to between 96 and 104, and the temperature remained below 100. Bile was discharged freely from the wound and the patient gave every evidence of returning health. At 2.45 P. M. of November 13th, a tubercular focus in the left lung broke down and a pulmonary hæmorhage occurred which lasted until 7 P. M. The pulse arose at once to 140, and from this time on he grew weaker. There was never any return of abdominal symptoms; the bowels moved daily and the wound remained perfectly clean, the leukocyte count was 11,000. His pulse gradually weakened and he died on November 17th, the symptoms present from the time of the pulmonary hæmorrhage being those of cardiac asthenia.

A culture from the contents of the gall-bladder was examined by Dr. F. J. Sladen, Resident Bacteriologist of the Johns Hopkins Hospital, who pronounced it a pure culture of typhoid bacilli.

A PRACTICAL SUGGESTION IN THE REDUCTION OF DORSAL DISLOCATION OF THE HIP

By JOHN HUNT SHEPHARD, B. Sc., M. D., Coeur d'Alene, Idaho

On the 24th of April, 1908, in consultation with Dr. J. T. Wood, I saw a man 63 years old, who, while digging out a stump, working in a squatting position, was struck on the hip by the turning-over stump. The blow doubled him up with the following forces acting on the right hip: the main weight of the stump striking on the right side of the sacrum and ilium caused extreme flexion of the thigh on the abdomen, together with adduction and probably internal rotation.

When he was helped up it was found that he had sustained an injury of the right hip, which upon examination proved to be a typical dorsal dislocation. Under anæsthesia an attempt to reduce the dislocation by the method of Biglow was unsuccessful. The hindering factor seemed to be the contraction of the muscles which did not completely relax even under anæsthesia.

By traction in the usual manner on the leg flexed at right angles to the body accompanied by adduction and internal rotation, it was possible to get the head of the femur on the rim of the acetabulum, but when abduction, external rotation, and extension were attempted the head would slip away and nothing was accomplished. The difficulty seemed plainly to be insufficient traction in the plane at right angles to the pelvis.

I believe that all will agree that it is no easy matter to exert the necessary traction and at the same time to practice the movements of rotation, abduction, and extension, as is necessary when making use of the untorn portion of the Y-ligament of Biglow as a fulcrum for forcing the head into place. After making several unsuccessful attempts by the usual methods and believing that insufficient traction was responsible for my defeat I conceived the following method and was surprised at the ease with which reduction was accomplished.

With the patient lying on his back on the floor, completely anæsthesied, I had one of the neigh-

bors kneel at the patient's left side, facing his feet, and by placing one hand on each of the iliac crests firmly hold the pelvis to the floor. I then knelt on my left knee at right angles to the patient and even with the pelvis, on his right side; with my left hand I took a firm hold of the patient's right knee and with my right hand caught the ankle; then flexed the thigh to right angles with the body, and the leg a little more than a right angle with the thigh. I then placed my right thigh, about midway between my body and knee, under the flexed knee of the patient. By attempting to rise I was able to exert almost any amount of traction on the dislocated leg that I desired. By throwing my body forward as I attempted to rise I was able to get all the adduction of the thigh that was necessary. Thus I had traction and adduction to the required degree and my hands were still free to manipulate the leg in rotation, flexion, or extension as was required. By exerting steady traction on the leg, and when one is in this position it is not tiresome to hold steady traction, I manipulated the leg, hunting for the rent in the capsule. In a very few moments I was gratified to feel the head slip through the rent in the capsule and over the rim of the acetabulum, and then by extension and external rotation, which can be done for several degrees while traction is still continued, reduction was complete.

The advantages that this method possesses over any other seem to me to be:

1. The ease with which one can exert steady traction, and to almost any amount, for it is accomplished by the powerful quadriceps extensors assisted by all the muscles used in rising from the kneeling position.

2. The hands of the operator are free to manipulate the leg in any direction and by so doing can search for the rent in the capsule.

3. Reduction is accomplished without using any structure as a fulcrum, but by simply hunting for the way of escape that the head took at the time of the accident and then reversing the forces that produced it, and thus one does not increase during reduction, the damages already inflicted upon the tissues surrounding the joint.

CORRESPONDENCE. — THE GILLIAM OPERATION

EDITOR SURGERY, GYNECOLOGY AND OBSTETRICS.

Dear Sir:— In the July number of your journal Dr. J. A. Polak, in a report of pregnancies following ventrosuspension of the uterus, makes this statement: "Alexander's and its modifications, Dudley's, Baldy's as well as Goffe's, and vaginal fixation, have had attention, until Gilliam's method of suspending the uterus was published. In this operation, we thought we had an ideal procedure, as it permitted not only the performance of the necessary intraabdominal repair, needed by so many of these women, but allowed us to suspend the uterus by its natural ligaments. My records show that 33 of these operations were done, in which 6 primary suppurations occurred. Two patients became pregnant, and were delivered at term without complication. At the post-partum examination, a month after the confinement, their uteri were found low and retroplaced. A second objection is the likelihood of suppuration in the wound."

I am under obligations to Dr. Polak for giving me the opportunity to throw some light on this subject. I would state in the first place that so many suppurations, or indeed any case of suppuration following the operation of round ligament suspension of the uterus as devised by me is the result of faulty technic. I would not for a moment have it thought that I suspect Dr. Polak of carelessness or uncleanliness, but I am assured that in some one or more particulars he has done violence to some of the more susceptible tissues in such a way as to weaken their resistance. In my earlier operations I had not infrequent suppuration of a most discouraging character, until it occurred to me that it might be due to the bruising and stretching of the subcutaneous fat in the effort to retract it from the face of the fascia. For years past I have made it my practice to clear the fat from the face of the fascia with a sweep of the knife, since which time I have had no suppuration. It was a surprise to me to find that after these suppurative cases the uterus remained in its normal position, showing that the ligamentous attachments had not been severed. Now as to the retrodisplacement after parturition. This so far from being a fault is a recommendation for the operation. The ligaments elongate in pregnancy to accommodate themselves to the growing uterus (a happy thing for the woman), then after pregnancy undergo involution, slowly, to be sure, but in the course of time it will be found that the uterus is back in its place and the ligaments performing their function, just as before parturition.

D. TOD GILLIAM.

50 North Fourth St., Columbus, O.

TRANSACTIONS OF SOCIETIES

CHICAGO SURGICAL SOCIETY

A regular meeting was held May 8, 1908, with the President, Dr. A. J. Ochsner, in the Chair.

TRAUMATIC EPILEPSY

DR. ALEX. HUGH FERGUSON reported upon a case of traumatic epilepsy.

The result obtained from operative intervention in cases of traumatic epilepsy is always a matter of more than passing interest because it is likely to vary in different cases. Sometimes the result is entirely negative; at other times the condition of the patient is improved; while in still other cases a complete cure is effected. The case I wish to report presented some individual features which I think add to its interest.

Mr. L. R., aged 25, a native of British Columbia, had attacks of epilepsy for about fifteen years, the result of a kick on the head by a horse when he was five years old. Both parents are living and well; one brother and two sisters are living and well. One brother died in infancy. There is no history of nervous disease or any chronic affection in the family, although the mother is said to have been subject to fainting spells. To the best of the patient's knowledge, he never had convulsions or fits.

The patient had the usual diseases of infancy, such as whooping-cough, chicken-pox, diphtheria, pneumonia, and measles, and shortly before coming to Chicago he was infected with gonorrhœa. He uses tobacco and alcohol in moderation. Previous to the injury he was in perfect health.

When about five years old he was kicked by a horse at about the junction of the sagittal and coronal sutures, just in front of and above the arm center in the brain. Unconsciousness was not complete until about two hours afterwards. Late that night an operation was performed by Dr. R. G. Brett, and it was then found that a piece of the parietal bone, about the size of a quarter of a dollar, was missing. A careful search of the premises where the boy was injured failed to reveal the piece of bone, but on probing the wound in the brain something hard was struck deep down in the substance of the brain, a distance of fully an inch. This proved to be the missing piece of bone, and it was removed by Dr. Brett.

Suppuration occurred and the patient was confined to bed for about a month, during which time he had several convulsions. Recovery was protracted and was not complete for about six months. Soon afterward he began to suffer from periodic attacks of headache, which gradually increased in severity and frequency until the pain was almost continuous. The headache usually began at the back of the head, gradually extending forward until the entire head seemed to be involved.

The epileptic attacks began when he was nineteen years old. The first attack came on during sleep. He had his second attack the same night, and another attack the following night. For five months he had about three attacks a month, the attacks always coming on at night; in fact, most of his attacks occurred at night, each one lasting from two to three minutes. The sensations complained of by the patient were those of compression of the thorax and occipital headache, followed by unconsciousness. Sometimes the aura occurred in the form of numbness of the left arm and the left side of the face. He sometimes bit his tongue and lips, and he was told that he frothed at the mouth during the attack. At one time he had as many as sixty-five attacks in six days.

I saw him for the first time February 5, 1908. On examination I found a robust, well-developed young man, who gave a history as quoted above, except that the presence of the gonorrhœal infection was not discovered until after the operation, the patient having denied venereal infection. At the site of the injury there was a deficiency of the skull-cap which was replaced by a very firm scar which at times was tender to pressure. Firm pressure very often produced some mental disturbance, particularly dizziness, and even brought on a fit.

On the following day I operated, removing the entire cicatrix, which was firmly adherent to the edges of the bones, so that I had to split it in order to remove it more easily. I removed sufficient bone with the rongeur forceps so as to expose healthy dura matter. On exposing the brain tissue, I saw at once that there was a difference in appearance between the brain substance under the normal dura and that beneath the cicatrix. The latter was soft, semi-liquid, and of a brownish color. There was much broken-down blood, with a number of small cysts, and a portion of brain substance about an inch in diameter was adherent to the membranes. I removed that completely with scissors and knife down to the white substance, feeling secure there was no injury of the motor centers. The degenerated portion of the brain was so completely destroyed that its removal could do no harm. If any of the centers had been involved, there would have been focal symptoms.

The operation was completed by packing the cavity in the brain with gauze, and over all a mammoth dressing, the intention being to cover the defect with an osteoplastic flap after healthy granulated tissue had filled up the cavity in the brain.

On the third day after the operation the patient had a rise of temperature. He complained of no headache, nor were there any symptoms of meningitis or other infection. Believing that the elevation of temperature might be due to too much pressure, I removed the bandage and packing, but the fever continued. Not until several days afterward did we learn that before his admission to the hospital the patient had exposed himself to gonorrhœa which developed after the operation and which accounted for the fever (cystitis).

On the tenth day the temperature began to subside, but the patient complained of a numbness of the right arm, and soon afterward developed a paralysis, which was complete

in about five days. Coincident with this paralysis was an aphasia. We knew that there was a protusion of the brain, a hernia cerebri, at the site of operation since the fourth day. A firm pad was placed over the denuded area, the brain itself having been covered with a piece of rubber tissue, and the gauze packing over this, and the whole was strapped down firmly with adhesive straps passing down over the chest to the umbilicus, so that the hernia could not increase in size or recur after it had been replaced. There was absolutely no sign of sepsis at any time, otherwise a different course of treatment would have been pursued.

There was a gradual return of power in the arm, and in about a week or ten days he commenced to speak. The motor power in the arm returned completely to the normal, and the arm now is as strong as ever. The patient also speaks quite well, although with some hesitation.

On March 5th, I performed an osteoplastic operation, covering over the denuded spot. Feeling that that would not be sufficient to keep the brain from protruding, I inserted a silver plate made of a twenty-five cent piece, which had been hammered until it was thin and frayed at the edges. The center of the piece was perforated. This was not intended as a permanent dressing but only for temporary use. I had considerable experience with these silver plates years ago, and came to the conclusion that I would not use them again, because they invariably caused trouble and had to be removed. However, on this occasion I elected to use the silver plate as a temporary means until sufficient cicatrization had taken place to prevent the hernia returning.

On April 17th, there was a sinus in front of the plate, and I curetted it. That night he had a fit, and four days afterward he had an indefinite fit, that is, he was not sure that he had a fit, but he had some soreness of the tongue and lips the next morning. I removed the silver plate, and allowed the scalp to heal over, and so far the result is entirely satisfactory. This case brings up many questions cerebral in character, as well as to the use of the silver or other plates. For instance, what was the cause of the aphasia? The only explanation I can give is that it was the result of irritation and traction on the fibers which go to the speech center.

It was interesting to observe that right arm paralysis and aphasia came and went in response to the degree of reduction of the hernia. After the removal of the packing that retained the brain tissue within the cranium for 72 hours, immediately the brain began to throb and to protrude until a hernia over an inch long formed within three minutes. The larger the hernia became the more profound was the paralysis of the arm and speech, and *vice versa*.

DISCUSSION

DR. D. W. GRAHAM: I think this is too important a case to go by without any discussion. Of course, you all know how prone we are to draw conclusions as to the result of an operation for epilepsy. Many of these cases are followed by a period of apparent recovery after operation, then recurrence takes place. I suppose everyone of us from experience knows that some of these cases apparently recover permanently, although the lesion found at the operation was not sufficient to account for the symptoms and for the manifestations. I think neurologists agree that almost any case of epilepsy is improved temporarily by operation of some sort. That is the way they explain the improvement following the application of the old-fashioned set onto the back of the neck. While this case reported by Dr. Ferguson is a good basis for his claim, yet we are not certain the patient will be permanently cured by the operation.

Regarding hernia of the brain, I think one may question the Doctor's position regarding the cause of the hernia cerebri. It is my understanding that we do not have hernia cerebri unless there is infection. We may have suppuration. You can make a hole in the skull and if you do not get infection you will not have hernia cerebri. You might take off one half of the skull and not have a protrusion of the brain. The brain is a fixed quantity unless you get swelling or infection. The brain is not like the viscera in the abdomen, seeking a place to get out.

Dr. Ferguson, like all the rest of us, when he has a case of operation for epilepsy followed by great improvement or an apparent cure, is very apt to think that it is permanent. That is human nature. We are all prone to think that way, and sometimes we find we are mistaken. I believe, however, that this man had some infection in the brain in the area of the operation, and that accounts for the hernia cerebri. I cannot account for it on any other ground.

DR. JULIUS GRINKER: I do not agree with Dr. Graham that unless there be infection there cannot be hernia cerebri. On the contrary, we expect considerable protrusion of brain substance, or so-called hernia cerebri, when we deprive the brain of its hard coverings, the skull and dura. This will appear quite logical after a short review of the physiological movements of the brain and the maintenance of pressure equilibrium in the cerebral cavity. The brain expands (a) from the dilatation of the large vessels at its base, (b) from respiratory movements — expiration, and (c) as a result of its own expansile movements of from one to six times per minute. With each expansion the tendency is to increase the pressure towards the cortex, but the latter being encased by the unyielding skull, there is a rebound towards the central portion of the brain, where conditions permit slight yielding. The ventricular system which is in communication with the subarachnoid and spinal fluids, is capable of equalizing brain and arterial pressure according to the needs of the moment, while at the same time it subserves the useful purpose of carrying on the lymph circulation. This salutory arrangement must be disturbed when part of the cranial vault is removed, and thereby a new point of least resistance to all sorts of pressure created. By repeated onslaughts of this pressure towards the cortex the

weak spot yields, permitting the mass of brain substance to protrude through the opening. Of course, my experience has so far been with pathological brains in which hernia cerebri is commonly observed. Reasoning from the foregoing premises, I would expect hernia in any brain deprived of its bony and dural coverings.

THE PRESIDENT: Is there anyone who can give us the results of animal experimentation in these cases.

DR. E. J. SENN: Dr. Keen, of Philadelphia, who is probably the best authority in this country and perhaps in the world, asserts that it is impossible to have a hernia cerebri without infection.

DR. D. A. K. STEELE: I have thought possibly in this case of Dr. Ferguson's there was an old or latent infection which did not manifest itself on the surface of the brain, but was a deeper infection because before the eventual recovery of the young man there was a discharge of turbid fluid and subsequently of pus. Of course, that raises the question whether the infection was due to the introduction of foreign material, as, for instance, the silver plate, and whether or not the presence of this plate was responsible for the rise of temperature and other symptoms. Certainly, it would hardly account for the paralysis and the convulsive seizures that occurred later on after its removal.

I agree with all that has been said by Dr. Graham, and with the statement made by Dr. Senn, namely, that in all the cases of hernia cerebri I have seen, there has been infection. In fact, I have not seen a hernia cerebri without infection.

DR. FERGUSON (closing the discussion): I am very much pleased with the discussion. It is but natural in considering hernia cerebri for the older surgeons, like myself and Dr. Graham, to think of infection as the principal etiologic factor. Before experiments upon the brain were conducted, and in pre-antiseptic days, these cases were all considered instances of hernia cerebri due to infection, but to-day we know that none of them were true cases of hernia cerebri. They were fungoid cerebri due to infection and were principally composed of pseudo-granulation tissue.

To-day, I think, every surgeon teaches that there are two kinds of hernia cerebri, one, which is due to the brain tissue protruding in the direction of least resistance, when there is a destruction of brain tissue, as we found it in a recent case treated aseptically. There was no infection in that case. There was no meningitis. There was nothing to indicate an infection. There was no elevation of temperature afterwards.

I question the memory of my friend, Dr. Senn, in regard to the statement that Dr. Keen had met with no case of hernia cerebri except when there was infection present. This is the second case I have had in my own practice. It is true, we sometimes remove a large piece of skull without hernia cerebri following, probably when the membranes are intact. I remember one case I had some years ago, when fully three inches of the bone was taken off and the membranes were restored by repair, and, strange to say, there was no epilepsy following in that case. That brings up the point in connection with operations that I wish to mention, namely, that in treating a case of traumatic epilepsy we must remove more tissue and cover it with something that will not produce hernia cerebri, and not simply deal with the adhesion itself. Here we had a very clear indication to remove the diseased brain tissue.

THE PRESIDENT: I would like to ask Dr. Ferguson whether he has made a study of the causes of absence of hernia in cases in which the dura has been removed together with the skull?

DR. FERGUSON: I have not made any special experiments in that direction. I looked up the literature quite thoroughly recently, and of the material I have read, the work of Bayliss, which came out last year, covers the field very well, particularly the theories relating to nonseptic and septic hernia cerebri. The matter is fully explained in that work.

PAPILLOMA OF BOTH OVARIES.

DR. ALEX. HUGH FERGUSON reported this case as follows:

Mrs. H., aged 25 years; family and personal histories inconsequential; began to menstruate at the age of 14. The menstrual history is without any bearing on the subsequent history of the patient. About December, 1906, she began to suffer from nausea, some vomiting, and headache, and there was cessation of the menses; in fact, all the symptoms that usually indicate pregnancy. The abdomen became enlarged and a probable diagnosis of pregnancy was made by the family physician. Every preparation was made to receive the expected baby. The enlargement of the abdomen increased, until finally it was of tremendous size. The patient lost steadily in weight, and when first seen by me was very much emaciated. This was in November, 1907, when I made the diagnosis of probable tumor of the ovaries, malignant in character. The ascites at this time was very marked, and the patient suffered considerably from gastric disturbances, palpitation, dyspnœa, and headaches.

After the gradual withdrawal of fluid from the abdomen by capillary drainage, a laparotomy was performed. To have operated at once would, in my opinion, have meant death; therefore I resorted to this temporary capillary drainage, a procedure which I had made use of in several cases before, always with good result.

In extreme cases of ascites or distension from ovarian cysts it is unwise and inadvisable to remove all of the fluid by aspiration at one time, because of the possibility of shock, and even fatal collapse, which such a procedure entails. A very simple means for alleviating these dangers

especially in the case of patients to be operated on, is to institute what may properly be termed *capillary drainage*. The patient is prepared in the usual manner, and after local cocaine anæsthesia, a trocar and cannula are passed into the abdominal cavity, as is customary. It is preferable to use an instrument of sufficiently large caliber so as to permit of carrying out easily the further steps of the procedure. The trocar is then removed and fluid is drained off, sufficient to relieve the patient of distress and discomfort. A dozen or more strands of silkworm gut are then passed into the peritoneal cavity through the cannula, and the cannula is withdrawn. By tying a knot in the silkworm gut strands, or in some other equally purposeful manner, the gut is kept from slipping into the abdomen. Of course, the ends of the silkworm gut that are passed into the abdomen are first seared so that they will not irritate the peritoneum.

A large gauze pad is placed over the drain to absorb the fluid, and this pad is renewed as often as is necessary. If drainage ceases, a strand or two of silkworm gut is withdrawn, and the flow is re-established. This step is repeated as often as is necessary until all of the fluid has been drained off. This usually occurs in about five or six days. In the meantime, the patient is getting rid of the fluid, is gaining in strength, and is comfortable. Any procedure which may have to be carried out subsequently is, therefore, more likely to prove successful.

The secretions of the kidney went from 7 ounces to 50, and the patient's condition improved so much that I operated about a week afterward. I found a double papilloma of the ovaries and tubes, extending over the fundus of the uterus. I did a double ovariectomy and salpingectomy, also removing the uterus. The immediate recovery was excellent, but at the end of two weeks there was a large reaccumulation of fluid. The patient went home after three weeks, but returned to the hospital later, when I withdrew the fluid and washed out the abdominal cavity through a large catheter with salt solution for three or four days, to stimulate the peritoneum to take care of the ascitic fluid. She did well for a while, but returned again with a considerable accumulation of fluid.

I opened the abdomen and found that the abdominal cavity was divided into two parts, an anterior part filled with fluid and epithelial debris, and a posterior part which contained the stomach, intestines, and other viscera. In other words, there was a false diaphragm, extending from in front of the stomach down to the upper border of the bladder. I opened this second cavity freely, washed it out and mopped it out and hunted for some pathologic condition. I failed to find one. The site of the original operation was in good condition. We washed out this anterior cavity and closed the abdomen. The patient has since gained in flesh and is in excellent health. A complete cure seems to have been effected.

DISCUSSION

Dr. Daniel N. Eisendrath: There is one step in Dr. Ferguson's treatment which I believe is to be commended, and that is preliminary drainage by means of a capillary drain, thus gradually relieving the intraabdominal tension. That is a feature we do not consider sufficiently. It is a subject which we are trying to work up experimentally, and is one which has been attracting considerable attention. The sudden withdrawal of large quantities of fluid from the abdomen during operation is at times a source of considerable shock and sometimes a very vital factor in determining the outcome. Drs. Capps and Lewis found, for instance, that when they packed pleural cavities, there was considerable lowering in the blood pressure, sometimes sufficient almost to have a fatal effect on the animal. I have noticed this a number of times in human beings in whom there was the sudden withdrawal of large quantities of blood from the abdominal cavity after injuries to the solid organs, such as the liver or spleen, or subcutaneous injuries. The fall in blood pressure would be from 130 or 140 down to 70, as measured, and that is why I believe in a case like this, where we have a large tumor and a considerable quantity of fluid, it is a wise preliminary step and one which we ought to practice much more frequently than we do.

Dr. A. J. Ochsner: I should like to draw the attention of the Society to one feature that was demonstrated in this case of Dr. Ferguson's very nicely — a feature to which Pozzi, of Paris, drew attention some ten or twelve years ago, and repeatedly since, namely, that in these case of papillomatous cyst of the ovary the recurrence is practically in the region of the broad ligamets, and that by removing the uterus, together with the ovaries and tubes, and grasping as far down the broad ligament as possible, without injuring the ureter, the secondary infection is obviated, following the removal of the growth, and that although there may be secondary implantations of the papilloma upon the surface of the visceral peritoneum, the intestines, or parietal peritoneum, those implantations may be destroyed naturally, and there will not be any permanent secondary implantations. The peritoneal cavity may be found perfectly smooth later on, and in this case Dr. Ferguson found at the secondary operation that the peritoneum was perfectly smooth, so that the chances of a permanent recovery are very much facilitated.

Dr. Pozzi reports many of these cases and a number of other surgeons who have followed him for many years have had the same experience. In these cases the more complete and thorough the operation, the more likely we are to effect a permanent cure.

Dr. Ferguson (closing the discussion): I have emphasized the importance of preliminary drainage and have extended it to the chest wall, to the knee, and the other conditions in surgery besides fluid in the abdominal cavity. This is the first case I have seen where the abdominal cavity was divided into two cavities, as this was. That was a very interesting feature to me.

CARCINOMA AND ADENOFIBROMA OF THE BREASTS

DR. ALEX. HUGH FERGUSON: I have another case I wish to say a few words about. Three days ago I removed two breasts from a woman, 49 years of age. The right breast I removed without going into the axilla, because, in my opinion, it was an innocent growth, being of eleven years' standing, and not giving any trouble except its size. It was an adenofibroma. In the left breast there was the retracted nipple, and as you will see by this photograph, it is a case of scirrhus of the breast with a typical history — symptoms, signs, etc. The two conditions were present in the same woman, carcinoma of one breast and adenofibroma of the other.

I do not think it is necessary to say any more about the same, unless we go into a general discussion of the ablation of the different structures connected with operations upon the breast.

I will ask my assistant, Dr. Zapffe, to demonstrate these two breasts.

DR. FRED C. ZAPFFE: The right breast shows the adenofibroma of eleven years' standing just above the nipple. The growth is encapsulated, of semi-firm consistency, about the size of a goose egg, and microscopic sections show very nicely the characteristic structure of adenofibroma, the adenoma being of far more recent development than the fibroma.

The carcinoma was removed from the left breast, and shows the retraction of the nipple. The tumor is situated just above the nipple, and originally was about the size of a pigeon's egg, very hard, dense, and cut with considerable difficulty. Under the microscope the tumor shows nicely the characteristic structure of carcinoma, showing the cell nests filled with cuboidal epithelium and without the basement membrane.

DR. E. M. BROWN reported the following cases: Mr. President and Members of Chicago Surgical Society:

The first case to which I wish to call your attention to-night is that of this young man to my left from whom I removed the hepatic flexure of the colon, for carcinoma, about January 15th of this year (1908).

I have here the tumor, which I will be pleased to have you examine while I give a brief history of the case before and since the operation.

The case is of interest first, because of the age. of the patient and second, because of the very slight disturbance produced by the growth until a short time before the operation.

The patient, Mr. H. S., is only 19 years of age. of German parentage, and is a clerk by occupation. His family and personal history is negative, except that at six years of age he had typhoid fever. His typhoid was not severe and no complications occurred during the attack. His present trouble was first noticed about six months ago when he began to have, as he says, "slight indigestion with a tendency to gas formation in the stomach." Because of this he ate less than usual and in the two months before his operation lost about twelve pounds in weight. His bowels, which previously had been regular, were becoming gradually more constipated. Up to this time he had no pain except occasional colicky pains which he ascribed to flatulency.

Until January 5th of this year when symptoms of acute obstruction first appeared, he did not feel that there was anything seriously wrong in the abdomen. On that date, January 5, 1908, after a hearty meal, he was taken with severe abdominal pain, paroxysmal in character, and accompanied by severe vomiting.

His family physician (Dr. H. J. Way of this city) was summoned and after lavage of stomach and bowels the patient felt better, but not well. As he explained it, he felt that if he could have a good bowel movement he would be well.

On January 7th I saw the patient in consultation with Dr. Way, the symptoms of intestinal obstruction being then classical, (1) pain, paroxysmal in character, (2) stercoraceous vomiting, (3) a doughy mass in the region of the cæcum and ascending colon. An operation was advised but refused. However, two days later, on January 9, 1908, he presented himself at the hospital in a rather serious condition. His pulse was 120, resp. 40. Abdominal distention and pain was extreme. Stercoraceous vomiting was frequent and profuse. It looked an unpromising case.

An exploratory incision with the purpose of draining the bowel was made in the median line. A nodular mass as large as one's fist was found in the hepatic flexure of the colon. This mass was not outlined before the incision because of its continuation with the doughy mass proximal to it, because of the tenseness of the abdominal muscles, and because of the extreme gaseous distention.

The bowel was drained at the cæcum as it lay close and greatly distended against the parietes on the right side. The cæcum was securely sutured to the parietal peritoneum before being opened. A large rubber tube held by a purse-string suture was placed in the opening in the bowel. Drainage was free and the patient recovered rapidly.

Two weeks later, through an incision higher up, I removed the growth in the hepatic flexure of the colon. About ten inches of the colon with its

mesentery and a few enlarged mesenteric glands were removed, and an end to end anastomosis was made. The Connell method of suture was used, reinforced at points by the Halstead stitch. The suture material was silk.

The patient made a good recovery. It is now about three months since the operation and he has gained twenty pounds.

The growth proved to be a cylindrical-celled carcinoma (E. R. LeCount) and I have here some slides for those who care to examine under the microscope.

The next case is that of Mrs. W., referred by Dr. J. S. Pigall of this city, German, 53 years of age. Mother of three grown, healthy children. Family and personal history, negative. About three years ago she noticed a small nodule below the angle of the jaw on the left side. This grew slowly until it reached the size of a walnut, at which it remained until about six months ago, when it began to grow rapidly until it reached the size of two fists. I have here part of the growth which I wish you to examine. I have here also a picture of the patient before the growth was removed. The tumor caused no pain or discomfort further than that due to its weight and unsightly appearance.

The patient was operated on by me in the absence of Dr. Ferguson, at our clinic at the College of Physicians and Surgeons on February 14, 1908. The case is of interest because of its resemblance in location to a tumor of the thyroid gland, and because it is representative of that class of so-called endothelial tumors so often found in the region of the parotid gland. However, this was not of the parotid but the submaxillary gland.

The tumor was encapsuled, pulled out easily, and the patient left the hospital in less than a week.

DISCUSSION

Dr. E. Wyllys Andrews: It does not seem as if the tumor exhibited by Dr. Brown sprang from the parotid gland, yet until recent years these tumors have been classed with the sarcomas, and according to Herzog and one or two other observers they are almost always primarily myxomatous, and they really, like endotheliomas in other parts of the body, are prone to have cartilages. Keen removed one probably three times as large as this one shown, of long-standing, from a man, who made a perfect recovery. He never had a recurrence after four or five years. I have seen the patient and photographs. At the same time, I do not feel in this specimen there is any hard cartilaginous tissue.

Dr. Brown (closing the discussion): I will say that the specimen passed around is a good representation of the mass as it appears there, and as containing practically all the elements found in the tumor. Dr. Andrews is right. This tumor belongs to that class of so-called "mixed tumors." It is an endo-myx-chondronea, or, to be correct according to Dr. E. R. LeCount, a chondronea. It is a tumor of the submaxillary gland and is so stated in my paper. I have here some slides made from the tumor for those who wish to examine under the microscope. I wish to thank the members of this society and Dr. Ferguson for the privilege of reporting these cases here to-night. I wish also to acknowledge the assistance of Dr. E. R. LeCount, who aided me in the pathological report.

A CASE OF SIMULTANEOUS GRITTI-STOKES AND PIROGOFF AMPUTATION

Dr. Samuel C. Plummer: I show you first a case of amputation. My experience with amputations is that we generally lose track of the patients after they once leave the hospital, and we do not know what the ultimate functional result is, but in this case the patient returned after four years, and is with us to-night.

When nineteen years of age he met with a crushing injury of one foot, and of the other leg, and I did the amputations the same day after he recovered from shock. I did a Pirogoff amputation on one side, and a Gritti-Stokes amputation on the other. The advantage of the Stokes modification of Gritti's amputation is that in Gritti's amputation the section is made through the lower end of the femur at the broadest part of the condyles. You can only get the patella down over the sawn edge by making some tension on the quadriceps extensor, and then you have a small sawn surface of patella against the large surface of the femur, and there is quite a disparity in their sizes. Stokes advocated making a supracondyloid incision through the femur, so as to have the size of the sawn section approximately that of the sawn surface of the patella, and in these cases you get the two surfaces approximated better, not only because they correspond in size, but because the section of the femur being higher up, there is less tension on the patella. It lies over the end of the femur. In this case I remember when the patient left the hospital there was no union between the patella and femur, and I wondered whether there ever would be, but when he came back he had good union. You can see how well he gets along with part of one foot, and the other leg off above the knee. It is a great advantage in having the patient young, because it is easier then to adapt

any apparatus than it would be in a person who is older. He was only nineteen years of age when he sustained the injury, four years ago. The os calcis was saved, turned up, and united with the lower end of the tibia. Both were osteoplastic amputations. The scar in the Pirogoff amputation, you see, comes in front. There is no scar over the end of the stump.

DISCUSSION

DR. D. W. GRAHAM: This patient, whose case Dr. Plummer has reported, has an advantage over the ordinary patient, so far as the Pirogoff amputation is concerned. Of course, he has his Pirogoff with the normal length of the leg and foot together, and then with his artificial show on, that raises him higher than normal, so that he has the advantage of being able to make his artificial leg correspond with that. He, therefore, has that advantage over the ordinary Pirogoff.

DR. E. WYLLYS ANDREWS: I think the result is so beautiful in Dr. Plummer's case that it is well worth while bringing the man here to show the result. If we can get such results as that from amputations in general, it would be very gratifying. I am partial to the Pirogoff operation, particularly in injuries about the ankle and knee joints, where we wish to sustain the bearing parts of the body, in spite of the instrument-makers, who are against us. The patella bears the weight of the body for hours at a time, where there is a natural cuff, whereas the other stumps in the continuity of the limb bear the weight on a collar raised up.

DR. PLUMMER reported two other cases, one of double uterus, the other of tumor of the spinal cord.

The cases are as follows:

CASE OF DOUBLE UTERUS

Ruth Winniford, Marseilles, Ill. Age, 15; female; occupation, student; habits, no tea or coffee; single; race, American; weight, lost somewhat. Referred by Dr. A. L. Stebbings, Marseilles, Ill. Entered Wesley Hospital November 21, 1907. Operation November 22, 1907.

Family History, negative.

Personal History. (1) Diseases of childhood and adolescence; measles, mumps, varicella, pertussis, scarlatina, malaria.

(2) Traumatisms, none.

(3) Operations, none.

(4) Menstrual history. Began 2½ years ago, type 35 to 40 days usually, pain severe 1 to 3 days, duration 6 to 7 days. Backache more severe recently, but not at each menstruation, flow varies but not excessive, no blood clots. Leukorrhoea since onset of menstruation.

(5) Present trouble; (a) Enlarged and tender clitoris; (b) Cervix obliterated, as patent; (c) Uterus symmetrically enlarged; (d) Induration posterior and to right of uterus; (e) Painful and irregular menstruation.

Examination. A swelling can be felt on the right side low down by palpation over the abdomen. This swelling feels hard, like a fibroid nodule.

Vaginal examination shows a small short cervix with a small os. A uterine probe can be passed by directing it well toward the left side; uterus is of normal depth.

Bimanual examination under ether anæsthesia shows a cyst-like tumor, apparently three inches in diameter low down in pelvis to the right of cervix.

Operation. Median incision. The body which could be felt through the abdominal wall at once presented and was found to be the distended right Fallopian tube. This was folded upon itself and its total length was ten or eleven inches. The proximal one and one-half inches appeared normal, the distal portion being tensely distended to the diameter of an inch and a quarter. The tube was removed to facilitate further operating.

It could now be seen that the uterus from which the tube had been removed was distended with fluid, and, deep in the pelvis and connected with the uterus, was the cyst-like body which had been felt upon examination.

Upon searching for the left tube and ovary, they were found attached to a second uterus about one inch in diameter, lying well to the left of the pelvis. This uterus connected with the normal vagina. It was thought at first that the cervices of the two uteri were connected, but further dissection showed them to be entirely separate.

I now made an incision into the right uterus and inserted a large cannula, through which thick reddish-brown fluid escaped. By pressing on the cyst-like body below, its contents could also be forced up through the cannula.

The right ovary was found also to be filled with thick reddish-brown fluid, nothing being left of the ovary except its wall.

The right broad ligament was now clamped and cut through, freeing the right uterus with its ovary. A circular incision was now made through the peritoneal coat of the uterus low down and the lower portion of the uterus, as well as the wall of the cyst-like body, which no doubt was a distended rudimentary vagina, were now enucleated. At certain places it was necessary to use the scissors in separating these structures. The right uterus, ovary, and rudimentary vagina were now removed entire. There was no opening made into the normal vagina at this time.

A forceps was now inserted into the vagina from below and a drainage opening made, through which a gauze drain was drawn. The divided peritoneal surfaces were now united so as to leave no surface in the abdomen uncovered by peritoneum. The abdominal wound was closed without drainage.

Recovery was uneventful.

Patient discharged from the hospital December 7, 1907.

TUMOR OF SPINAL CORD

Case of Ora Brown, tumor of spinal cord. Operation Wesley Hospital, January 4, 1907.

Patient in semiprone position on left side. Ether anæsthesia.

Incision in median line of back, beginning just below the seventh cervical vertebra and extending downward to the seventh dorsal. The muscles were cut away from the sides of the spinous processes from the first to the sixth dorsal vertebræ, inclusive, on the left side. Several vessels were clamped and ligated, and a hot laparotomy sponge was packed into the wound, while on the right side the muscles were separated in a similar manner. Hæmorrhage having been checked, the vertebral grooves were now cleared with a chisel by using the spinous processes as a fulcrum and pushing the tissues away from the laminæ.

The spinous process of the fifth dorsal vertebra was now cut off with a bone-cutting forceps, and the ligamentum subflavum between it and the fourth dorsal severed with a knife. A special laminectomy forceps was used to cut away part of the laminæ of the fourth dorsal vertebra and the remainder was removed with the rongeur forceps. The laminæ of the second, third, and fifth vertebræ were removed with the rongeur forceps.

The dura, which now lay exposed from the lower border of the first to the upper border of the sixth vertebræ, appeared normal in color; nothing abnormal could be felt on palpation. Pulsation seemed normal, but it was noticed that it was stronger in the upper third than in the lower two-thirds.

The patient's head was now somewhat lowered and the dura opened in the median line. Opposite the third dorsal vertebra a tumor was found lying between the membranes and the cord behind and to the right. Using the handle of the knife this was easily delivered, and the small pedicle broken off. Its exact attachment was not ascertained.

The anæsthetist noticed at this time that the pulse, which up to this time had been but little higher than normal, suddenly became very fast and difficult to count.

The dura was now closed with a continuous catgut suture, and the muscles brought together with interrupted catgut sutures, leaving a space for a gauze drain down to the dura at the upper and lower extremities of the wound. Skin closed with silkworm-gut sutures, a secondary suture being used at each end where the drain came out. Voluminous drainings.

In 48 hours one gauze drain was removed and in 72 hours the second one removed, the secondary sutures being tied after removal of the drains.

Aseptic healing.

DISCUSSION

DR. JULIUS GRINKER: The patient referred to by Dr. Plummer was twenty-three years of age, and presented a good family and personal history. She was the picture of health, well nourished, and had never suffered from any complaint that may be interpreted as tuberculosis, nor did she ever sustain injuries. The history of her present trouble is as follows: About a year ago she developed pains in the right hypochondriac region, which were diagnosed as intercostal neuralgia — a common diagnosis. Some thought she had stomach disease, because the pains later radiated into the epigastric region. This pain was limited to the right side for some weeks. Later the left also became affected, but the right side continued to be painful as before. She also experienced some pain in the back. On September 23, 1906, she felt a numbness and stiffness in the left leg; also in the right, where it began, but the left side disabled her to a degree. She could still walk with a limp, but after a short time the right side became similarly affected. She walked into a North Side hospital, but after two weeks she became thoroughly disabled, so that walking was impossible. Then she developed a feeling of tightness below both knees; her legs became stiff and she lost all sensations below the umbilicus. Three or four weeks later her sphincters became completely paralyzed. No diagnosis had been made in this hospital. She was given large doses of antispecifics, because of the possibility of this being syphilis, although she presented none of the signs of specific disease. I first saw her in consultation with Dr. Goldspohn, whose patient she became after she had left the first hospital. He concurred in my diagnosis of tumor of the spinal cord opposite the third dorsal vertebra and agreed to operate, but the patient left this, the second, hospital, without any material change in her condition, because operation was not consented to by those who cared for her. When I next saw her, she had become a patient at the Wesley Hospital. Dr. Plummer, to whom the case was assigned, kindly asked me to see the case with him. We examined the patient conjointly; he concurred in the diagnosis, and performed a successful operation, from which the patient made an uninterrupted recovery. The tumor was found where we localized it before operation.

It might interest you to know how I made the diagnosis. I deserve no great credit for it. Sometimes the diagnosis is very plain and it was so in this case. My only surprise is that it had not been made in the hospital where she had been previous to having become Dr. Goldspohn's patient. What did I base my diagnosis on? Persistent pain on one side, with a tendency to extend to the opposite side, the subsequent development of symptoms of compression, such as stiffness, rigidity, and, last, paralysis of the sphincters. These symptoms should enable anyone to diagnose spinal tumor. She had in addition the Babinski, Oppenheim, and Gordon signs, and ankle clonus. The sensory disturbances were somewhat peculiar. Up to a certain level all qualities of sensation were lost. Then came a small strip in which touch and temperature were lost and another strip in which there was only loss of tactile sensations. The charts, which I now pass for your inspection, show this plainly. The limit of tactile anæsthesia bordering at the sixth dorsal segment, it was apparent that the tumor was probably opposite the third spinous process. The sensory charts which I used were Seiffer's, which I consider the most reliable and sufficient for practical diagnosis. Of course, we had no way of telling whether the tumor was benign or malignant, but from the general appearance of the girl, I thought the tumor was benign. I ventured the opinion that the tumor was probably intradural, but was not certain. The differential points usually given are not reliable. My opinion was based on the fact that the neuralgic symptoms had not been very severe; in extradural tumors the

posterior roots are early involved and the pain is excruciating. During the course of operation, we expected the tumor to be a little lower than where we found it; in consequence one or two more vertebræ were exposed than was absolutely necessary. All writers on spinal tumors tell us that we should look for the tumor rather too high than too low. Horsley, who in 1887, successfully operated on the first spinal tumor, had a similar experience, and so had others. Although the operation was extensive, the girl did well, and, remarkable as it may appear, almost immediately after the operation, say within twenty-four or forty-eight hours, she suffered excruciating pain in the analgesic areas. These pains lasted several days. On the third day after operation she noticed the difference between a hot water bottle and a cold one. She recognized temperature before any other sensory quality. As time went on, she perceived pain and touch. At present she feels all qualities of sensation perfectly, with the only exception that she does not localize very exactly, probably within one-quarter of an inch of the right spot. The sphincters act normally.

Does she walk? No; she never will; she suffers from contractures, spasticity, and lead-pipe rigidity in the lower extremities, because her pyramidal tracts have degenerated and will never be restored.

The lesson to be drawn from this case is that the time to operate on this patient was when she first presented herself. Had this been done, there would have been a complete success. As it is, we have what may be called only partial success. But is it not better to restore to a paralytic her sensations than to have her die of bedsores? Had the operation been performed before the pyramidal tracts had completely degenerated from continued compression by the tumor, the result might have been different.

The case is extremely instructive from the point of view of diagnosis and treatment. In conclusion, I wish to say to you, the representative surgeons of our city, have every suspicious case of spinal tumor thoroughly examined by a neurologist, with a view of immediate removal of the tumor, if one be diagnosed. I do not believe in procrastination. Neither do I think it necessary to put these patients on potassium iodide and mercury, because of the small probability that such tumors are gummata. As a matter of fact, gummata of the cord are rare, and we are wasting valuable time by delay in operating. And finally, I wish to thank both Dr. Goldspohn and Dr. Plummer for the privilege of studying this interesting case.

DR. D. N. EISENDRATH. Why is it the pyramidal tracts are so much more early affected by pressure than the sensory tracts?

DR. GRINKER: No one definitely knows why the pyramidal tracts and the motor fibers, in general, are more susceptible to injuries of all kinds, but the fact remains that after a nerve has been severed, it does not take long before sensation is restored. In fact, sensation is never entirely lost when one nerve root has been cut. Unless two or three segments are destroyed, you have not complete anæsthesia anywhere. The motor tracts are later in developing, and seem to be more highly organized, and degeneration in them takes place more rapidly, sensation being less vulnerable, perhaps because it lies at the foundation of life. If it were not for sensation, we could not exist for a moment.

ABSTRACTS OF CURRENT LITERATURE

DEPARTMENT OF SURGERY

UNDER THE CHARGE OF

JOHN B. MURPHY, M. D.
FREDERIC A. BESLEY, M. D.
WM. C. DANFORTH, M. D.
AIMÉ PAUL HEINECK, M. D.
E. WYLLYS ANDREWS, M. D.
WM. R. CUBBINS, M. D.
M. G. SEELIG, M. D.
GEO. E. BEILBY, M. D.

Suppurative Phlegmonous Gastritis. J. WESLEY BOVEE, M. D., Washington, D. C. *The American Journal of the Medical Sciences*, May, 1908.

Dr. Bovee reports a case of suppurative phlegmonous gastritis, which was chiefly located in the pyloric portion of the stomach, which was operated on and recovered. There was a marked abscess formation in the anterior wall of the pyloric portion, which was incised and drained with a tube. The wall of the stomach was thickened in all except the fundal portion. The author reviews the literature carefully and after summing up the facts both etiologic, pathologic, and symptomatic, decides that a diagnosis cannot be made without an exploratory laparotomy. The etiology is far from clear but the pathology found, follows the general character of the previously reported cases. This is probably the first successfully operated case reported in the literature. WM. R. CUBBINS.

The Relaxed Knee-Joint. ALBERT H. FRIEBERG, M. D., Cincinnati, Ohio. *The American Journal of the Medical Sciences*, May, 1908.

Dr. Frieberg reports several cases in which the knee-joint was relaxed without any nervous or mechanical change to account for the condition. He believes that it is due to a relaxed condition of the quadriceps extensor muscles, which is the normal tensor of the anterior portion of the capsule. This is due, the author believes, to a primary atrophy of the quadriceps, which follows an injury. The symptoms are very similar to the locking from movable cartilage or villous growth projections into the joint, the latter, the author believes, are usually second to this relaxed condition. The treatment consists in massage, exercise, and electrical stimulation until the muscle is restored to its normal tone. WM. R. CUBBINS.

Symptom Complex of Transverse Lesion of the Spinal Cord and Its Relation to Structural Changes Therein. ALFRED REGINALD ALLEN, M. D., Philadelphia, Pa. *The American Journal of the Medical Sciences*, May, 1908.

Dr. Allen discusses those injuries of the spinal cord where there is a more or less complete suspension of function, and which are not due to transverse severance of the cord or to the loss of the myelin sheath. In other words, the spinal cord, following a trauma or a severe grade of compression, may cease to functionate and the microscopic and macroscopic examination fail to show any but the slightest changes in the myelin sheaths. It is in this class of cases that the author believes the opinion that the cord may regenerate has originated. He reports a case of metastatic carcinoma where the compression caused a complete suspension of function and in which he found only a few swollen axis cylinders and swollen medullary sheaths. WM. R. CUBBINS.

The Direction of the Jejunum in the Operation of Gastroenterostomy. B. G. A. MOYNIHAN, M. S., F. R. C. S., London, Eng. *Annals of Surgery*, April, 1908.

Mr. Moynihan emphasizes especially the value of the jejunal loop being attached to the stomach in an almost vertical line with the least inclination to the right. He does not believe that the direction of the jejunum to the right or to the left is of serious import but prefers the short loop of the jejunum to the right. A warning as to the evil consequences of rotating the bowel upon its long axis is also made, as this is a very effective method of obstruction and can be made very easily unless especially avoided. WM. R. CUBBINS.

Transfusion and Arterial Anastomosis. REUBEN OTTENBERG, M. D., New York. *Annals of Surgery*, April, 1908.

Dr. Ottenberg reports experimental and clinical results from arterial anastomosis and transfusion. The author states that his work is corroborative and not new. The arterial anastomosis was made with small grooved rings, through which one end of the artery is pulled and a cuff turned back so that the endothelium is exposed. Over this, the other end is pulled so that the endothelium is approximated; this is fixed by two silver wire bands. In the experiments properly carried out this method was highly successful, and it proved to be easily performed. In the two clinical cases reported, the method of transfusion was perfect and from a technical standpoint successful, although the ultimate results were not good, owing to the severity of the underlying cause. The history of transfusion is also reviewed clearly and concisely. WM. R. CUBBINS.

On the Thymus Gland Treatment of Cancer. FREDERIC GWYER, M. D., New York. *Annals of Surgery*, April, 1908.

Dr. Gwyer reports sixteen cases of cancer, treated by the administration of a preparation of thymus gland, in which there has been at least some amelioration of the symptoms. Those which were improved showed less pain, smaller mass, and general improvement of condition. Those that died presented a somewhat different picture than the usual carcinoma cases, in that there was no great loss of weight and no local increase of the growth. The author is not convinced entirely that there is not some danger attached to the administration of the drug, and has used it in combination with various drugs in the hope of making it more effective without giving too large doses.

WM. R. CUBBINS.

The Relationship of the Serous Cavities to Circulating Bacteria (Ueber das Verhalten der serösen Körperhöhlen gegenüber im Blute Kreisenden Bacterien). A. PEISER, M. D. Breslau Clinic, Professor Garré, Director. *Beiträge zur Klinishen Chirurgie, bd. lv.*

Peiser made use of cultures of B. Pyocyaneus, which were injected into rabbits, this organism being used because it is known to be pathogenic to rabbits, and because the distinctive color of the pus is an aid to the location of infected points. These were killed at periods varying from 20 minutes to 18 hours after injection. In the first series of experiments, in which the serous membranes were not disturbed, invariably the serous cavities were found to be uninvaded. In a second series, 20 minutes previous to injection the animals received 10-12 cc. of sterile bouillon through a cannula in the abdominal cavity, or 1 cc. in the pleural cavity. In order to rule out the possibility of the small cannula wound being the point of entrance for bacteria from the circulation, controls were used, in which a cannula, but no bouillon, was inserted through the abdominal musculature in the lateral aspect of the abdomen. The injections were made through linea alba. In one animal salt solution was used instead of bouillon. The results of this series of experiments showed that when the peritoneum was subjected to even the slight irritation caused by the presence of sterile bouillon or normal salt solution, bacteria are able to invade it. The experiments upon the pleura gave similar results.

No experiments are reported upon the pericardium, but a reported experiment by Bonti is quoted. He opened the pericardium of a rabbit and injected one drop of oil of turpentine and closed the wound. After two days he placed under the skin of the animal fragments of an agar culture of Diplococcus Pneumoniæ. Death occurred after 3 days and a fibrinous pericarditis with pus culture of Diplococci was found.

While no experiments were made as to the susceptibility to infection of the meninges under similar conditions, the work of Sonneburg upon lumbar anæsthesia is quoted. The latter states that in 56 cases of Stovain anæsthesia one case of meningitis occurred. This was in a case of gall bladder empyema.

Kocher also is quoted to the effect that spinal anæsthesia is not adapted to use in tubercular individuals, he having seen two cases of tubercular meningitis follow its use in such cases.

Conclusions are as follows:

1. Bacteria circulating in the blood-stream do not enter the serous sacs so long as these are not injured.

2. When the serous membranes are irritated, even slightly, circulating bacteria enter them very quickly. It depends upon the virulence of the bacteria and upon the resistance of the individual what the results may be in a given case. W. C. DANFORTH, M. D.

Congenital Neurofibromatosis (Ein Beiträge zur Neurofibromatosis Congenita). H. RITMANN, M. D. *Beiträge zur Klinishen Chirurgie, bd. liii.* From the Leipzig Surgical Clinic, Professor Trendelenburg, Director.

Neurofibromatosis, or the so-called Von Recklinghausen's Disease, is characterized by the formation of neurofibromas, particularly upon the peripheral nerves, skin pigmentation, developmental defects, and idiotismus.

Ritmann reports a case in a man of 23 years, showing the typical signs of the disease and from whom several neurofibromata were removed. Microscopic examination, typical neurofibroma. In particular, this patient complained of sudden increase of intensity in the pain, which, as a rule, was of a lancinating character. Symptoms, as shown by the case reported, may be summed up as follows:

I. Cardinal symptoms.
   1. Neurofibromata upon left leg.
   2. Abnormal pigmentation of whole body.

II. Secondary symptoms.
   1. Failure to attain normal growth.
   2. Abnormal hairiness of legs.
   3. Angiomata and varices on the left leg.

Complications. Partial periosteal bone-changes; kyphoscaliosis of the spine; peripheral arteriosclerosis, and marked neurasthenia.

Prognosis in general of these cases is unfavorable. The tumors may undergo sarcomatous degeneration. These patients usually show a gradual cochexia and marasmus which finally ends in death.

Therapy is practically hopeless. Recurrences follow in a short time the extirpation of the tumors. This occurred in Ritmann's case. Symptomatic treatment is all that can be done.

As regards the late development of the tumors, Ritmann states that a congenital tendency to changes in connective tissue may not show itself till puberty.

W. C. DANFORTH. M. D.

Phlebitis of the Left Inferior Extremity after an Operation for Appendicitis (Phlébites du membre inférieur gauche apès l'appendicectomie à froid). L. ROBERT, *Thèse*, Paris, 1907.

Phlebitis of the left inferior extremity is a complication that may occur after an interval appendectomy. There may be no symptoms, the first manifestation being its most serious complication: emboli. It is a

manifestation, *à distance*, of a general infection of the organism, of an infection that has its origin primarily in the peritoneal cavity. It can occur without any infectious phenomena in the region of the operative wound. Its appearance is favored by the weakness of the patient who has had one or more attacks of appendicitis. It is more frequent in the left inferior extremity, because this extremity is mobilizable, while the right inferior extremity is immobilized owing to the pain which occurs during the attack, also on account of pain in the operative wound. From the practical standpoint, it is important to watch for pains appearing in the inferior extremities and the slightest oscillations in temperature. Be very cautious about allowing these patients to get up.

A Few Diagnostic Errors in Children (Quelques erreurs de diagnostic chez l'enfant). BARILLET, *Thèse*, Paris, 1907.

Acute appendicitis is very frequent in children. Usually the diagnosis is easy. The definiteness of the symptoms leads to precision in the operative indications. The study of the published observations, which are very numerous, the prolonged and continued observation of children operated for appendicitis, the comparison of the symptoms with the lesions found at the time of operation, the disproportion between these two factors, allow us to say that a certain number of diagnostic errors are committed from time to time. Some of them are curiosities and difficult to avoid. Others are common and can be avoided.

The condition may be simulated by a dermoid cyst, with twisted pedicle, by pneumococcus peritonitis, by diverticulitis, and by an acute salpingitis, but surgical intervention is indicated in all these cases.

In other cases the different forms of acute enterocolitis and intestinal parasites must be excluded. Tuberculous peritonitis, with attacks of intestinal occlusion due to them, simulate very closely attacks of appendicitis. Peritonitis due to gonococci often gives rise to the same error, which is unfortunate, because usually spontaneous cure is the rule in these cases. Various pulmonary processes, such as pneumonia and pleurisy, usually have a painful onset, and may give a painful abdominal point which will mislead us.

Riedel has noted during the last twenty-one months that appendicitis in children under 15 years of age has a mortality of 13 per cent. These figures are alarming, because almost all of these patients could have been saved by a timely and appropriate operation. The causes for this mortality are the following: The foolishness or carelessness of the parents as well as their unwise affection, which prevents them from placing their child in the hands of a surgeon. The diagnosis is more difficult to establish, according to most authors, than in adults. Infantile appendicitis has, owing to its anatomical causes, more dangers than in the adult. Inflammations of the appendix vermiformis are much more serious in infancy and childhood than later in life. According to most authors the diagnosis is more difficult and the dangers greater than in the adult.

Pulmonary Embolism Secondary to Appendicitis (De l'embolie pulmonaire dans l'appendicite). L. DRUAIS, *Thèse*, Paris, 1906.

Pulmonary emboli occur in medical and surgical conditions and especially in appendicitis. It occurs ordinarily during the convalescence from chronic appendicitis, and especially in those forms complicated by adhesions or abscess formation. There may be four different types: first, the mortal type, uncommon, rapidly causing death through syncope or asphyxiation; second, the benign type, causing infarcts and ending always in recovery; third, the insidious type, subvariety of the benign type, having a sudden onset, threatening symptoms of asphyxia and syncope, towards the last evoluting like a caseous pneumonia; fourth, the pyemic, due to small capillary septic emboli. This may be mistaken for complicating or post-operative pulmonary conditions, and may be attributed to the general anæsthetic. Pulmonary embolism in the condition under consideration has its origin in a phlebitis secondary to appendicitis. This phlebitis may be located at some distance from the infected focus. It is more often located in the parietal and visceral veins of the pelvis and lumbar region. During the operation, and this complication must be kept in mind, all manipulations should be gentle. If, after appendectomy, swellings and thromboses of the lower limbs occur, complete immobilization must be enjoined.

Vesiculo-appendicular Fistulæ (Fistules appendiculo-vesicales). G. PERRON, *Thèse*, Paris, 1907.

Appendiculo-vesicular fistulæ are usually due to an abnormal situation of the appendix (posterior, internal, pelvic). The appendix is near the bladder, if not in contact with it. The inflammation of the appendix is propagated to the neighboring tissue and leads to the formation of adhesions with the pericystic cellular tissue. When this becomes inflamed we have a pericystitis. Then comes irritation and inflammation of the bladder and thus cystitis is developed. If the process does not subside, the perforation of the bladder is established. These fistulæ are variable in shape, in size, and in dimensions. The symptoms observed, outside of those of appendicitis, are dysuria, later, pyuria, hæmaturia, etc.

When the fistula is established, fæces may appear in the urine. The diagnosis is then easy. If the urine contains fæces and if there are appendicular symptoms and the abscess has not passed unobserved, an etiological diagnosis is easy.

Left-sided Appendicitis (De l'appendicite à gauche). P. CHAUVEAU, *Thèse*, Paris, 1906.

There are cases of left-sided appendicitis. This abnormal situation of the appendix may be due to four different causes: First, inversion of the viscera; second, angulation of the transverse colon or the gravitation of the cæcum and appendix into the left pelvic fossa, either on account of laxity or the absence of the ligaments; third, deficiency of migration of the cæcum and of the appendix, as a result of which these organs

remain in the left iliac fossa; fourth, from the exaggerated length and transverse position of the appendix, which terminates by its free extremity to the left of the median line.

The clinical expressions of a left-sided appendicitis are the same as those of ordinary appendicitis, but the site of symptoms is usually closer to the median line. You must exclude sigmoiditis and perisigmoiditis.

Membranous Typhlo-appendicitis and Appendicitis (Typhlo-appendicite muco-membraneuse et appendicite). LE DENTU, Académie de médecine, 1906.

Though muco-membranous colitis may not be an important predisposing factor in the causation of appendicitis, the co-existence and at times, the correlation of one with the other, are not exceptional. This statement is more applicable to the chronic forms of appendicitis than to the acute forms. A few cases are reported in which membranous enterocolitis has been favorably influenced by an appendectomy. Too often this influence is *nil* or only temporary.

In some cases it is difficult to differentiate enterocolitis from acute or chronic appendicitis. In cases of doubt, an exploratory incision is as legitimate as in other fields of abdominal surgery. If the two conditions co-exist, operation is indicated, not because we wish to cure the enterocolitis by an appendectomy, but because of the dangers to which patients are subjected by the non-operative treatment of appendicitis.

Appendicitis Occurring in the Nursling (Appendicite chez le nourisson). E. STÉPHAN, *Thèse*, Paris, 1907.

Appendicitis is not uncommon in the first two years of life. It is more common during the first six months of the first year and the last six months of the second year. We have not been able to determine why it is almost absolutely absent between the eighth and fourteenth months. The author has been able to collect fifteen cases after the first year and eighteen cases during the second year; therefore, appendicitis is apparently slightly more frequent during the second year of life. Among the causes of the disease in this period of life may be mentioned the infectious diseases and gastro-intestinal disturbances.

The appendicitis of the nursling may have a sudden onset or its onset may be marked by gastro-intestinal disturbances. In one or the other case, its evolution is unusually rapid. Without remission, diffused peritonitis quickly develops, and this is the more common the younger the patient. The safety of the patient lies in operation. Immediate operation is indicated. No recoveries have occurred before the eighteenth month.

Senile Appendicitis (L'appendicite sénile). MERIEL, *Revue de gynécologie et de chirurgie abdominale*, April, 1907.

Beginning at the 50th year, the vermiform appendix may be considered as a lymphoid organ regressing more or less rapidly and completely. These changes lead to obliteration of its cavity and to atrophy or disappearance of the lymphoid tissue. Thus, deprived of its essential elements, this organ loses all its worth as a favorable soil for appendicitis. There are cases where these involutionary changes are tardy and thus we can have senile appendicitis, that is, cæco-appendicular inflammation.

Gand reports thirty operations for appendicitis upon patients past fifty years of age. There were seven deaths. The mortality is due to the delay entailed in making a diagnosis.

Primary Cancer of the Vermiform Appendix and Cæcum (Cancers primitifs de l'appendice vermiforme du cæcum). M. LETULLE, *Revue de gynéc. et de chir. abd.*, 1907.

The author gives the histological description of eleven primary cancers of the iliocæcal appendix and summarizes the different characteristics of these neoplasms.

The cancer is located not far from the free extremity of the appendix, often at the seat of the old inflammatory appendiceal lesions. The tumor is not voluminous, rarely exceeding the volume of a cherry-stone. Its consistency is hard, its color is white. Histologically, two varieties can be noted. Cylindrical cellular epithelioma, and a more or less typical carcinoma. We must remark that despite the rapid cancerous infiltration of the walls of the appendix, this cancer is comparatively benign. Metrastasis is very rare. Cancer of the appendix is observed at all ages. M. Letulle says that the patients having cancerous appendices have previously had serious attacks of appendicitis. It is only by the systematic examination, both histologically and microscopically, of all appendices that we will be able to more correctly appreciate the frequency of this condition. About fifty cases have been reported since 1897.

Treatment of Dislocation of the Shoulder-joint, Complicated by Fracture of the Upper Extremity of the Humerus. J. M. MASON, M. D., *Annals of Surgery*, May, 1908.

Dr. Mason reports a case of fracture of the surgical neck of the humerus, complicated with dislocation, which was reduced by the open operation and the fractured bone wired. He makes a strong plea for this treatment in preference to manipulations or resections on account of the perfect functional results

Sub-temporal Decompressive Operations for the Intracranial Complication Associated with Bursting Fracture of the Skull. HARVEY CUSHING, M. D., *Annals of Surgery*, May, 1908.

Dr. Cushing reports fifteen cases of bursting fracture in which sub-temporal decompression was made, with two deaths. In these two fatal cases the author believes the cause to be that he made only a unilateral decompression.

The advantages enumerated are:

1. That it is through the thin portion of the skull, the temporal muscle relieves the danger of a cerebral hernia, and the subsequent defect is absolutely harmless.

2. If hæmorrhage is present the clots can be removed and vessels ligated.

3. It gives the œdematous brain relief from pressure.

4. The unpleasant sequels are not so common.

The operation is accomplished through an oblique incision from above downward.

Clinical Study of a Few Uncommon Forms of Peritoneal Tuberculosis (*Etude clinique de quelques formes rares, de péritonities tuberculeuses*). R. MERRY, Thèse, Paris, 1907.

This article is divided into three parts: 1. Latent tuberculous peritonitis, with a sudden development of accidents; 2. Localized forms of tuberculous peritonitis presenting large tumors; 3. Tuberculous perigastritis.

Among the first acute intestinal occlusion may be the first symptom of a tuberculous peritonitis which up to that time has been latent. This intestinal occlusion may be produced by fibrous bands, by angulation of the gut, by adhesions of neighboring coils of gut, or by intestinal paralysis. The author reports a certain number of cases, and insists upon the difficulty of diagnosis. There are cases of tuberculous peritonitis simulating acute or chronic appendicitis. The author reports a few observations where tuberculous peritonitis produced symptoms simulatng such conditions as typhoid fever, renal or biliary lithiasis, salpingitis, etc.

The localized forms which present themselves with the aspects of tumors are formed by omental masses, by ascitic collections. These tumors are more commonly situated in the pelvis and are easily mistaken for a pyosalpinx, for a malignant tumor of the ovary. It is difficult to diagnose this condition. However, the slov evolution of the tumor, its irregular consistency, its indefinite limits, and the presence of tuberculous lesions elsewhere can put one on the proper path. Perigastric tuberculosis occurs chiefly in the adult male; the gastric signs, pain, vomit, hæmate mesis, etc., have nothing characteristic; neither are the local signs characteristic; but if your patient presents attacks of diarrhœa, moderate ascites, multiple adenopathy, it is permissible to think of a stenosis of tuberculous origin. Prognosis is always grave. AIMÉ PAUL HEINECK.

The Question of Operation for Non-penetrating Intracranial Trauma. JOHN A. HARTWELL, M. D., *Annals of Surgery*, July, 1908.

Dr. Hartwell divides these cases into four classes. First, those in which the injury is so slight that recovery is certain. Second, those in which the injury is so great that death is inevitable. Third, those in which the injury is of such a nature that operation is positively indicated. Fourth, those in which the indications for and against are evenly balanced — the border-line cases.

It is this latter class that he wishes to emphasize on account of the fact that a decompression alone affords relief in many cases.

Two cases of this type are cited and others of the more severe types in order to emphasize the contrast. He concludes from the analysis of these cases that:

1. In but rare cases, namely those of isolated injury affecting the sensory-motor area, can a positive focal diagnosis be made.

2. All grades of brain injury may be found in different parts of the same brain.

3. A general concussion may be followed by secondary changes in the circulation which, if not relieved, produce pressure and death.

4. A pure decompressing operation is indicated in two conditions: (a) for relief of pressure due to inaccessible hæmorrhage; (b) to relieve pressure from traumatic œdema of the brain.

5. Operation done without a very definite object in view — which object is based on careful diagnosis — is apt to be more harmful than helpful.

Transperitoneal Removal of Tumors of the Bladder. CHARLES H. MAYO, M. D., *Annals of Surgery*, July, 1908.

Dr. Mayo reports five cases of tumor of the bladder that have been operated upon by the transperitoneal method. The author prefers this route because it is more accessible, and the danger of a recurrence of growths is not so common, as there is no drainage. Malignant tumors are removed with cautery going well into the healthy mucosa. Ureters are transplanted to different parts of the bladder when necessary. From one half to two thirds of the bladder can be removed and still leave enough to functionate. Connell stitch, reinforced with a Lembert of linen, is used. Patient is catheterized until able to urinate.

Strain Fractures of the Knee. SIDNEY LANGE, M. D., *Annals of Surgery*, July, 1908.

Dr. Lange reports four cases of apparent strain of the knee-joint, where there was in fact fracture of the bony components as shown by the X-ray. These fractures were practically avulsions of the bony particles by the strong ligaments. They were internal and external, and in one case the crucial ligaments were involved.

Fracture through the Anatomical Neck of the Humerus, with Dislocation of the Head. JOHN J. BUCHANAN, M. D., *Annals of Surgery*, May, 1908.

Dr. Buchanan reports a case of this unusual injury and discusses the mechanism and the treatment. It is always caused by a fall on the shoulder, which force, the author believes, produces the primary dislocation. Then, as the weight of the body is thrown on the abducted arm, the head of the humerus is torn off by the edge of the glenoid cavity. Several specimens are illustrated to show the mechanism, which seems well founded. The author believes it best to remove the detached head through an incision. Complete bibliography.

BOOK REVIEWS

METABOLISM AND PRACTICAL MEDICINE. By Carl von Noorden, vol. III. THE PATHOLOGY OF NUTRITION. By Carl von Noorden, H. Salomon, A. Schmidt, A. Czerny, H. Steinitz, C. Dapper, M. Matthes, C. Neuberg, O. Loewi, and L. Mohr. Anglo-American edition edited by I. Walker Hall, Professor of Pathology, University College, Bristol. W. T. Keener & Company, Chicago.

The third and last volume of this masterly treatise follows closely upon its predecessors. It is impossible within the compass of a brief notice to detail the scope of this exhaustive volume or point out in more than a general way its many excellences. More than either of the other and earlier volumes, this one will appeal to the interest of the practitioner, owing to the practical clinical value of the problems dealt with. The general and special aspects of disturbed metabolism are reviewed with a thoroughness and comprehensiveness, and yet withal in such a practical manner as to place this volume without a rival in this department of medical literature. Where so high a general excellence prevails it is difficult to discriminate, still we may single out for special mention the chapters on the metabolism in diabetes and cognate conditions by von Noorden and Neuberg, the metabolism in diseases of children by Czerny and Steinitz and in diseases of the ductless glands by Magnus-Levy. An article of much interest and value on the influence of light Roentgen and radium rays on metabolism is contributed by Hugo Salomon. Extensive and conveniently arranged bibliographies enhance the value of the work to the specialist; and the addition by the editor of a complete list of the analysis and caloric value of the commoner foods, both cooked and uncooked, will materially increase the usefulness of the volume for the practitioner.

R. E.

LES LUXATIONS DES GRANDES ARTICULATIONS LEUR TRAITEMENT PRACTIQUE. Par les Docteurs J. Hennequin et Robert Loewy. Avec 125 Figures dans le Texte. Paris: Félix Alcan, Éditeur. 1908.

This extensive monograph of over four hundred pages deals entirely with luxations resulting from traumatism, and classified as complete or incomplete, depending upon whether the joint surfaces are completely or only partially separated.

Despite the fact that the volume, at first sight, has a somewhat forbidding theoretic aspect, it is nevertheless eminently practical, and this practical part is ably testified to by the numerous excellent illustrations of the methods of reducing the various dislocations.

All the large joints are studied in order, beginning with the shoulder, and the mechanical principles underlying the production of the dislocation and the rational method of reduction are clearly expounded. The anatomy of the joints is given in detail and the surgical technique necessary for bloody reduction is described. Symptoms are carefully considered from the point of view of aid to diagnosis; and after-treatment, that most important factor in the chapter of dislocations, is considered at length. The technique of making proper X-ray exposures, and of properly interpreting the pictures obtained is stated clearly, the volume ending with a discussion of the good service rendered by Bier's hyperæmia in the treatment of the various complications following ordinary dislocations.

M. G. SEELIG.

A SHORT PRACTICE OF GYNÆCOLOGY. By Henry Jellett, B.A., M.D., B.Ch., B.A.O., F.R.C.P.I., Gynæcologist and Obstetrical Physician to Dr. Steeven's Hospital; Ex-Assistant Master Rotunda Hospital, etc. Third Edition. Revised and enlarged, with 310 Illustrations. Philadelphia: P. Blakiston's Sons & Co., 1908.

Considered primarily as a text-book, this volume serves a most useful purpose, the subject-matter being clearly classified and presented, and the arrangement being rational and simple. All told, there are twenty-three chapters, two-thirds of which are devoted to the consideration of gynæcological diseases from the point of view of etiology, pathology, symptomatology, diagnosis, prognosis and indications for treatment. The remaining third is devoted to a detailed description of the various gynæcologic operations.

By way of praise, it may be said that the subject is stripped of all moot points, and only those opinions stated and measures recommended, which may stand fairly uncontested; but on the other hand, the noticeable absence of the purely personal element renders the book more or less unsatisfying to the practitioner.

The illustrations are uncommonly clear, and are, for the most part, original. Particularly clear cut are those plates illustrating the microscopical pictures of various lesions.

ABDOMINAL TUBERCULOSIS. By A. Ernest Maylard, M. B., B. S. (Lond.), Surgeon to the Victoria Infirmary, Glasgow; Late Examiner in Surgery in the University of Glasgow, and Victoria University, Manchester; Formerly Demonstrator of Anatomy, Guy's Hospital, London. Philadelphia: P. Blakiston's Son & Co.

This volume of 360 pages, covering the subject of abdominal tuberculosis, is a treatise which it is a pleasure to welcome among the monographs upon special subjects. It is to be hoped that the sale of this book, as well as others of its class, may be sufficient to induce the publishers to accept more of such monographs in the future. We have too many of the text-book style of publications, giving a needless repetition of well-known facts, and too few volumes dealing with special branches of work.

The book is excellently gotten out from a publisher's standpoint, with clear type and pictures.

It covers tuberculosis of the intestinal tract, small intestine, colon, and vermiform appendix, and the description of the lesions which come as the result of such ulceration. It also covers tuberculosis of the mesenteric glands, liver, gall-bladder, spleen, pancreas, uterus, Fallopian tubes, ovary, peritoneum, and the omentum.

Dr. W. K. Hunter has added a chapter upon the medical phases of this question, covering the general and prophylactic treatment of tuberculosis by antiseptics, serum, and vaccine, as well as the treatment in sanatoria. The text consists of a general description, covering the known facts upon the various phases of tuberculosis, supplemented by case reports gathered mainly from the clinical histories of Mr. Maylard.

It is a pleasure to recommend the book to those interested in this phase of surgery.

A TEXT-BOOK OF SURGICAL ANATOMY. By William Francis Campbell, M. D., Professor of Anatomy, Long Island College Hospital; Attending Surgeon to the Methodist Episcopal, Swedish, and Bushwick Hospitals, Consulting Surgeon to the Jamaica Hospital. With 319 illustrations. Philadelphia and London: W. B. Saunders Co.

This volume by Campbell, produced in the usual high-class manner characteristic of the publications of the W. B. Saunders Co., is an excellent résumé of the well-known points in surgical anatomy. It is illustrated by over 300 well-drawn illustrations, emphasizing the more important points in anatomy. The text itself is a clear, concise description of the matter usually covered by teachers in class-room work. It does not claim to be an extensive contribution dealing with any new points, only presuming to present the known points in an excellent manner.

THE PANCREAS: ITS SURGERY AND PATHOLOGY. By A. W. Mayo Robson, D. Sc. (Leeds), F. R. C. S. (Eng.), and P. J. Cammidge, M. B. (Lond.), D. P. H. (Camb.). Philadelphia and London: W. B. Saunders Co., 1907.

In this volume, which is devoted in its entirety to a discussion of the pancreas, we have one of the distinct advances in surgery. Its great value lies in the fact that under one cover a reader is able to get a clear picture of this gland from its origin in the lower forms of life through its normal anatomy and functions in man on to the most complicated pathological changes.

Hand in hand with these essentials to the man who wishes to acquire a concise knowledge of this hitherto rather obscure organ, there goes a wealth of information as to the symptomatology which can come only from the extremely careful and exact observation of all the details which the ordinary surgeon so commonly neglects.

The great value of studying pathology in the living is brought out to advantage, and the contrast to post-mortem records is indeed of a startling character.

The "pancreatic reaction" (Cammidge) is thoroughly considered and given in detail, with improvements that the authors have found to be necessary. It is distinctly a great aid and, although it has and will have detractors from less competent observers, it will remain one of the main points upon which disease of this gland is recognized. The chapters upon comparative anatomy, anatomy, and anatomical peculiarities, are concise, well illustrated, and of great value when one wishes to weigh the symptoms, an intimation of which is given as the student progresses.

In physiology, numerous authors are quoted and the various experiments carefully analyzed, in order to make the complicated reflexes and clinical actions clear.

In the chapters on pathology and fat necrosis, all the changes that are found in the gland are considered as to their cause and results, both from an experimental and clinical standpoint; but just why fat necrosis should be in a separate chapter is not exactly clear. Under clinical pathology, the changes in the blood, urine, fæces, and the contents of cysts are dealt with; and here one finds just how

much stress should be laid upon the examination of the fæces in order to make the pancreatic reaction of the urine most valuable. Some stress is also laid upon the presence of calcium oxalate crystals in the urine, and Opie's test with the fat-splitting ferment is considered, but not highly valued.

A separate chapter is devoted to diabetes, and the observations of numerous authors quoted and deductions from these and their own experience made to the effect that diabetes is much more frequently a complication of acute pancreatitis than has hitherto been observed and that the fibrosis which causes this disease, i. e., "interacinar," is usually the result of an acute inflammation of the gland. That the islands of Langerhans are directly responsible for the perverted metabolism seems clear. On the other hand, the author admits that, as yet, diabetes can occur without a demonstrable pancreatic lesion. In the experimental work reported in this line, the action of adrenalin in constantly producing glycosuria when applied directly to the gland is the most interesting and the most suggestive of the interrelationship of these organs. Bronzed diabetes and alimentary glycosuria are also considered, but more evidence is wanted before conclusions can be drawn.

Under general symptomatology and diagnosis, a very clear picture of pancreatic disease is drawn for the clinician, in which general and local signs as well as the clinical findings are grouped.

A few interesting cases are reported under injuries, so that one must remember that the gland is present when seeing a patient who has had either a blunt or penetrating abdominal injury; but the most interesting part is that which is devoted to the inflammations. In the classification, the author uses the word catarrhal rather more than we are accustomed to hear it in this country and the line drawn between suppurative catarrh and suppurative pancreatitis is rather sharp, and not altogether clear in some places; the main point seeming to be the violence of attack and rapidity of course. The varying virulence of different organisms is not followed as closely as some of the French authors would lead us to believe is necessary.

The predisposing causes are very clearly set forth, but it seems that the exciting causes should be the different bacteria underlying each attack, as I believe it to be a recognized fact that bacteria are present in each case of inflammation.

Under the subdivisions of the acute and chronic inflammations, case after case is cited in support of the more prominent symptoms until a well-marked picture is brought before the reader in such a manner that it would be difficult for him to overlook these changes.

The treatment, which is all conducted along surgical lines, brings out how much can be done for these cases by competent surgeons, but it especially emphasizes the frequency of gall-stones as a cause, and gives a timely warning against the too-frequent removal of the gall-bladder before it is definitely known that there is an absolutely healthy common duct and pancreas, as it can be so easily used to avoid an obstruction either from stenosis of the duct or cirrhosis of the head of the pancreas. Cysts and malignant neoplasms are also carefully considered and it is advised in the latter to avoid operation, as the results are uniformly bad. The differentiation between malignant disease and chronic inflammation can be made by the pancreatic reaction in 70 per cent of the cases, and is one of the main points of value in the reaction.

This work will certainly serve to place the surgery of this gland on a higher plane and will add to the present fame of the authors.

WM. R. CUBBINS.

STATE BOARD QUESTIONS AND ANSWERS, by R. Max Goepp (Saunders and Co.), is a compilation of questions asked by various State Boards during the last four years, together with answers of the same, which is a convenient and ready reference for candidates preparing for state board examinations.

The arrangement of the principal departments of medicine and surgery, together with an alphabetical index, gives access to many leading questions likely to be asked by any board; and, by supplementing the answers given by text-book references, one may cover the general field quite thoroughly.

The questions stand out in heavy type while the answers are in smaller but clear type, making the text easy of differentiation. H. A. POTTS.

GLANDULAR ENLARGEMENTS AND OTHER DISEASES OF THE LYMPHATIC SYSTEM. By Arthur Edmunds, M. B., M. S., B. Sc., Lond., F. R. C. S., Eng. London: The Oxford University Press, 1908.

This small volume from the pen of Arthur Edmunds, M. B., M. S., etc., makes no pretension of being an exhaustive treatise on the diseases of the lymphatic system, as such a monograph would entail practically a review of the whole of medicine and surgery.

The subject of the book has been considered from a practical and from a surgical standpoint, and its limitations have been defined by considering only those pathological conditions in which affections of the lymphatic vessels or glands constitute the essential feature of the disease.

This volume on practically a new subject is interestingly written, well illustrated by drawings, photographs, and skiagraphs. F. H. M

DISEASES OF THE HEART. Nothnagel Series. By Prof. L. V. Schrotter, Prof. T. v. Jurgenson, and Prof. L. Krehl; edited with additions by Prof. George Dock, University of Michigan, Cloth, pp. 848. Price, $5.00, net. Philadelphia: W. B. Saunders Co.

This volume is an authorized translation from Nothnagel's Encyclopedia of Practical Medicine. It is the best and most comprehensive contribution to the study of diseases of the heart extant. The authors, all of whom are internists of broad experience, have given detailed consideration to all phases of the subject and have added to each chapter a complete literature. The myocardial diseases and the neuroses of the heart are particularly well presented. The treatment throughout is rational, thorough, and efficient.

ROTUNDA MIDWIFERY FOR NURSES AND MIDWIVES. By G. T. Wrench, M. D. Oxford University Press.

This work of about three hundred pages, as the title states, is a text-book for midwives and nurses on obstetrics; it contains very little on the subject of nursing itself, but is a very elementary and superficial digest of a text-book on obstetrics and care of the baby and without previous teaching of the subject for some time at Rotunda Hospital, would leave the reader with a wrong impression of the work as carried on at above hospital.

The chapter on the conduct of a normal labor case and especially the precautions to be taken as regards cleanliness, is excellent, as are the numerous illustrations, the wording of the book, and the print.

According to America's present day standard, the book is considerably behind the times, and, without going into too much detail, one would particularly mention the chapters on the diagnosis of pregnancy, conduct of third stage, care of the breast and umbilical cord.

The work seems to encourage midwife practice; and privileges allowed them according to the author would, I am sure, lead to an infinite amount of harm.

Midwife practice was, at one time, thoroughly discouraged at Rotunda and it is to be regretted that the present administration has not kept up the good work. MARKS GOLDSTINE.

STUDIES FROM THE LABORATORY FOR SURGICAL RESEARCH. Department of Surgery, Columbia University. Vol. I, 1907.

PRACTICAL MEDICINE SERIES. Volume II, 1908. Edited by John B. Murphy, M.D. Year Book Publishers, 40 Dearborn St., Chicago.

This is one of the series of reviews of the entire subject of medicine presented by the Year Book Publishers, one appearing every month. This This volume upon general surgery is very complete and is a valuable review of the year's output in surgical literature. The comments by the editor, Dr. Murphy, make the volume of especial value.

BOOKS RECEIVED

HERNIA: ITS CAUSE AND TREATMENT. By R. W. Murray, F. R. C. S. London: J. & A. Churchill, Philadelphia: P. Blakiston's Son & Co., 1908.

ADENOMYOMA OF THE UTERUS. By Thomas S. Cullen, M. B. Philadelphia and London: W. B. Saunders Company, 1908. Cloth, $5.00, net; Half Morocco, $6.50, net.

GOEPP'S STATE BOARD QUESTIONS AND ANSWERS. By R. Max Goepp, M. D. Philadelphia and London: W. B. Saunders Company, 1908. Cloth, $4.00, net; Half Morocco, $5.50, net.

DISEASES OF INFANTS AND CHILDREN. Revised edition. By John Ruhrah, M. D. Philadelphia and London: W. B. Saunders Company, 1908. Flexible leather, $2.00, net.

PRACTICE OF MEDICINE FOR NURSES. By George Howard Hoxie, M. D. Philadelphia and London: W. B. Saunders Company, 1908. Cloth, $1.50, net.

SURGICAL ANATOMY. By William Francis Campbell, M. D. Philadelphia and London: W. B. Saunders Company, 1908.

A SYSTEM OF SYPHILIS. In six volumes, edited by D'Arcy Power, M. B., Oxon., F. R. C. S., and J. Keogh Murphy, M. D., M. C., Cantab., F. R. C. S. With an introduction by Jonathan Hutchinson, F. R. S. London and New York: Oxford University Press. 1908.

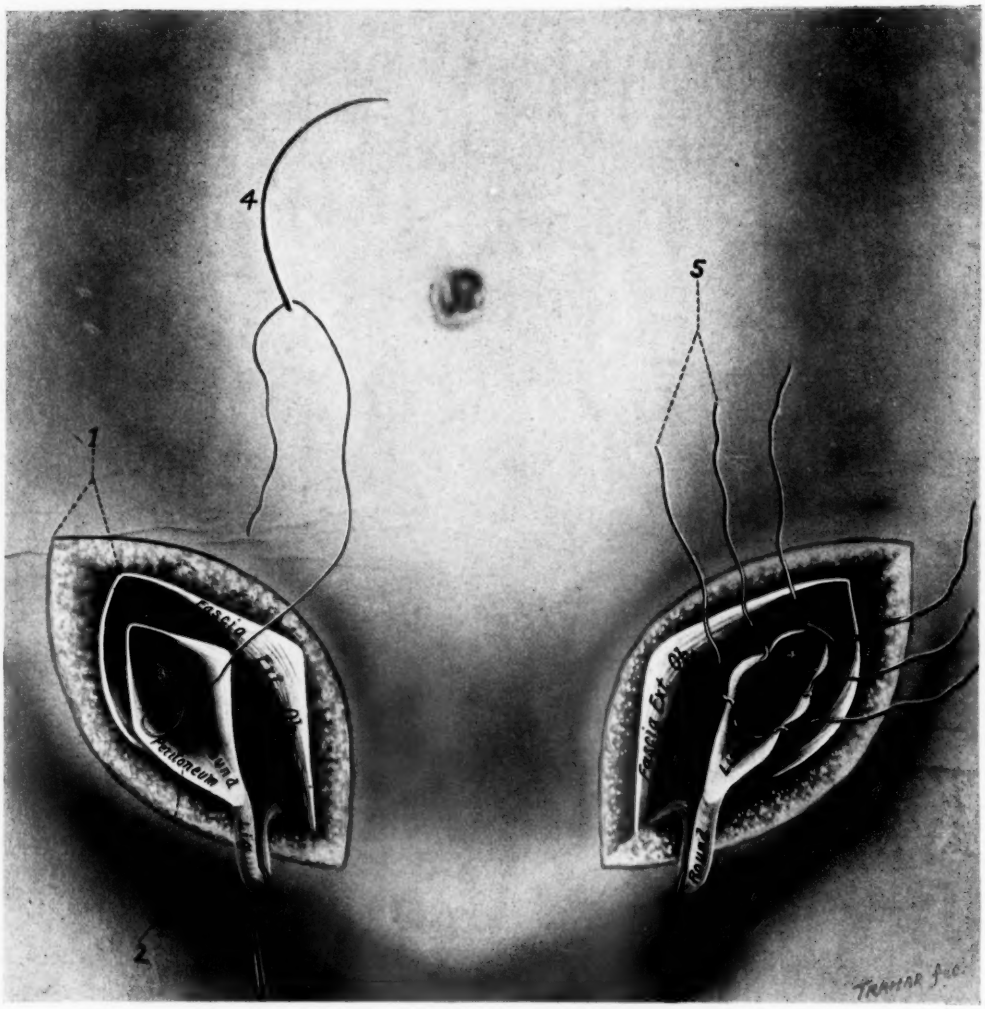

Fig. I. Open Alexander operation. Steps: (1) Make incision through skin, fat, and fascia of external oblique as in operation for hernia. (2) Draw out round ligament with attached peritoneum and split peritoneal sac. (3) Examine and treat adnexæ through incision. (4) After pulling out peritoneum suture within internal ring, thus leaving a considerable portion of the peritoneum external to the peritoneal cavity proper. (5) Pass chromicized catgut sutures through internal oblique muscle, peritoneal sac from within, including bight of round ligament, and out through Poupart's ligament and tie them. (6) Complete the closure of the wound as in a Bassini, or, if preferred, a Ferguson operation for hernia. (R. C. Coffey.)